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TTS 37BAQ SERIES

NOISE—LEVEL-VU MEASURING SET

VIKING LABORATORIES INC.

Northeast Electronics Instruction Manual
A0037-89-600 Issue 4 MAY 1979

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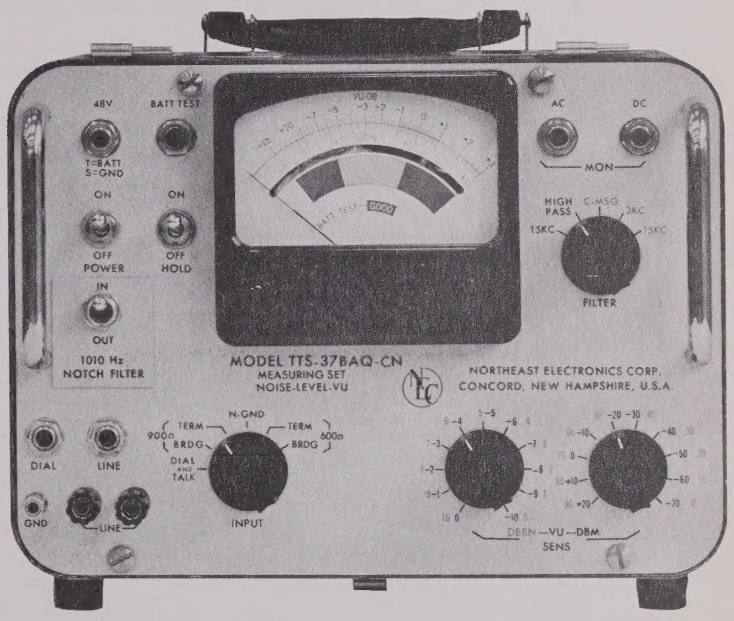

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION.

1.2 The Northeast Electronics Model TTS 37BAQ is a compact, portable test set that performs level, speach power (VU) and noise tests over telephone circuits. It can measure level in either average or quasi-rms values of dc current over a +23 dBm to −95 dBm sensitivity range. Noise level is measured over a +113 dBrn to −5 dBrn range. The approximate speach power is measured in three ranges and indicated by three different colored arcs on the VU-DB meter. The meter ballistics have not been accurately calibrated to provide precise indications. Switchable input filters are provided to attenuate low-frequency energy near 60 Hz, high-frequency energy above the voice band or allow C-message weighting with or without a band-elimination notch filter centered at 1010 Hz. A dial can be connected via the TTS 37BAQ to the line under test and a hold coil is provided to seize the line.

1.3 Two monitor jacks for ac and dc outputs are located on the front panel for easy access. The ac monitor jack can be used to drive such equipment as an impulse noise measurement set or a telephone headset to determine the nature of the signal under test. This monitor jack can also be used as an external circuit driver that functions as a variable, high-gain amplifier. The dc monitor jack output can drive external equipment such as a 1 milliampere recorder.

1.4 The overall test set sensitivity can be varied from −80 dBm to +20 dBm in 1 dB and 10 dB increments by two stepped attenuators. These attenuators are also calibrated from 0 dBrn to 100 dBrn. Two color schemes are used for ease in identification. Black marks on the front panel and meter scale indicate dBm values, blue marks indicate dBrn values.

1.5 Balanced or unbalanced circuits of either 600-ohm or 900-ohm impedance can be measured in either a terminated or bridged condition. Noise-to-ground can be measured with a 40 dB loss with a longitudinal drain.

1.6 The TTS 37BAQ is equipped with internal batteries that provide approximately 230 hours of life with intermittent use. A battery test pushbutton measures the battery condition or proper external power source or central office battery connection. Diode protection for internal circuits is included.

1.7 The TTS 37BRAQ is a rack-mounted version of the portable test set. It does not have an internal battery supply and must operate from a −48 Vdc external source such as a central office battery. All paragraphs that follow will apply to both the TTS 37BAQ and TTS 37BRAQ unless otherwise noted.

1.8 The Model TTS 37BAQ portable test set has two optional cover accessories. One is a Model TTS 37XPS Ac Power Supply Adapter. It allows the test set to be powered from a standard 115 or 230 volt ac line voltage at 50 Hz to 60 Hz. The other accessory is a Model TTS 37XDT. It provides a standard dial and talk circuit for use with the TTS 37BAQ.

SECTION 2

SPECIFICATIONS

2.1 **INTRODUCTION.**

2.2 Table 2—1 lists Model TTS 37BAQ and TTS 37BRAQ specifications. Specifications for the TTS 37XDT and TTS 37XPS cover accessories are listed in Tables 2—2 and 2—3 respectively. Figures 2—1 through 2—3 illustrate various TTS 37BAQ filter frequency response curves.

Table 2—1. Model TTS 37BAQ/BRAQ Specifications.

METER CALIBRATION	
Tracking Accuracy:	± 0.15 dB maximum error from +3 dB to —3 dB on scale.
Scale:	VU-DB scale calibrated in black divisions from +3 dB to —15 dB. 0.1 dB divisions between +1 dB and —1 dB. 0.2 dB divisions between +1 dB and +3 dB, and —1 dB and —3 dB. 0.5 dB divisions between —3 dB and —10 dB. 1.0 dB divisions between —10 dB and —15 dB. dBrn scale and dB scale are the same except that dBrn values are marked in blue from +13 dBrn to —5 dBrn. VU quality scale marked in three colors; Green between 0 and +3 dB, yellow between —6 dB and 0 dB, red between —15 dB and —6 dB. Green arc marked GOOD for BATT TEST.
RANGE OF MEASUREMENTS	
Level Measurements:	+23 dBm to —95 dBm.
Noise Measurements:	+113 dBrn to —5 dBrn.
Noise-to-ground Measurements:	+113 dBrn to —5 dBrn.
INPUT IMPEDANCES (Balanced input transformer)	
Terminated:	600-ohms or 900-ohms, ± 5 % with phase angle of less than 5 degrees when hold coil is out of circuit.
Bridging:	12,000 ohms on 600-ohm circuit. 15,000 ohms on 900-ohm circuit.
Longitudinal Drain:	85,000 ohms across the line. 100,000 ohms to ground.

Table 2—1. (Cont'd)

FREQUENCY RESPONSE (Normalized to 1 kHz at ordinary room temperature)	
C-msg:	—3 dB from 625 Hz to 710 Hz and from 2800 Hz to 3100 Hz. —40 dB from 85 Hz to 115 Hz and from 6000 Hz to 7000 Hz.
High Pass:	—3 dB from 13 kHz to 16 kHz with 18 dB/octave slope at higher frequencies. Not less than 45 dB rejection at 60 Hz.
3 KC (kHz):	± 0.25 dB from 100 Hz to 1000 Hz. —3 dB from 2.8 kHz to 3.2 kHz with 18 dB/octave slope at higher frequencies.
15 KC (kHz):	± 0.25 dB from 100 Hz to 5000 Hz. —3 dB from 13 kHz to 15 kHz with 18 dB/octave slope at higher frequencies.
1010 Hz Notch Filter:	± 0.5 dB from 100 Hz to 400 Hz and 1700 Hz to 10 kHz. ± 3.0 dB from 400 Hz to 862 Hz and 1182 Hz to 1700 Hz. —50 dB from 995 Hz to 1025 Hz. +5 dB input level.
ATTENUATOR	
Accuracy:	± 0.15 dB from +10 dB to —60 dB. ± 0.3 dB from +20 dB to —70 dB.
HOLD CIRCUIT	A low-resistance hold coil can be switched in or out.

NOTE

At frequencies below 200 Hz, the low-resistance hold coil will have an effect on response characteristics and will therefore effect the measurement accuracy if left in the ON position.

AC MONITOR	
Output Impedance:	600 ohms.
Output level:	Approximately —10 dBm when meter reads 0 dB.
DC MONITOR	
External Dc Resistance:	Must not exceed 300 ohms and must be isolated from ground.
Output:	Approximately 0.7 mA when meter reads 0 dBm.

Table 2—1. (cont'd)

STABILITY OF CALIBRATION

Temperature (with respect to readings at 25°C):	± 0.1 dB from +20°C to +30°C. ± 0.3 dB from 0°C to +50°C.
Battery Voltage (within green BATT TEST arc):	0.05 dB change.

POWER REQUIREMENTS

Battery Operation:	Two 9-volt Eveready No. 2356 or equivalent batteries.
Battery Life:	Intermittent use - approximately 230 hours. Continuous use - approximately 210 hours.
Battery Current Drain:	Approximately 11 mA (without Ac Monitor).
48V Operation:	Requires 48V office battery. Disconnects internal battery when 48V jack is used.
48V Current Drain:	Approximately 35 mA.

PHYSICAL DIMENSIONS

Size (TTS 37BAQ):	11 in. w x 8 in. h x 10 in. d (279.4 mm w x 203.2 mm h x 254 mm d).
Weight (TTS 37BAQ):	14 pounds (6.3 kg).
Size (TTS 37BRAQ):	19 in. w x 8-23/32 in. h x 6 in. d (482.6 mm w x 221.6 mm h x 152.4 mm d).
Weight (TTS 37BRAQ):	Approximately 14.25 pounds (6.47 kg).

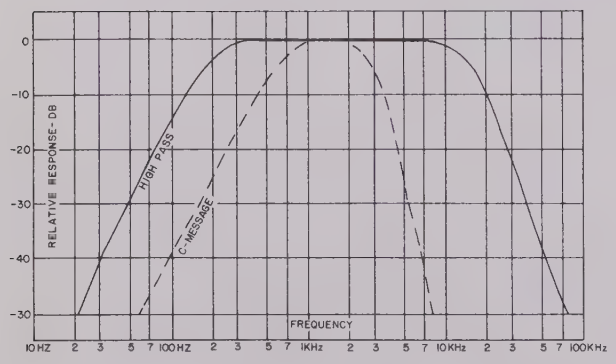

Figure 2—1. C-Message and High-Pass Filter Frequency Response Curves.

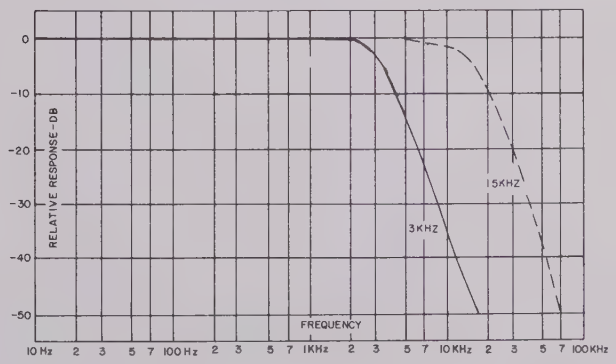

Figure 2—2. 3 kHz and 15 kHz Filter Frequency Response Curve.

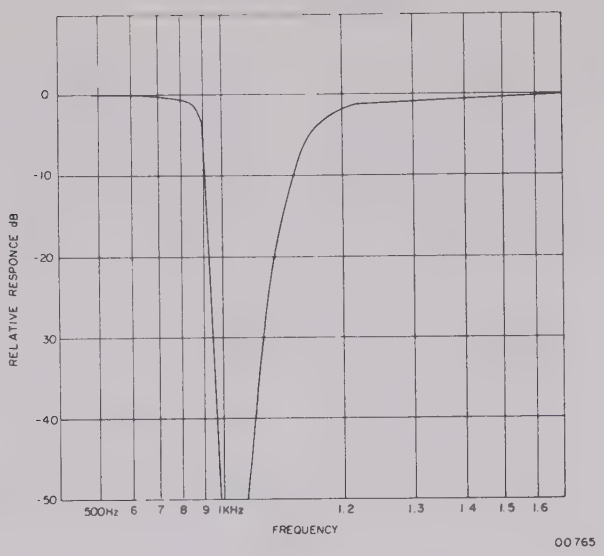

Figure 2—3. Optional 1010 Hz Notch Filter Frequency Response Curve.

Table 2—2. Model TTS 37XDT Dial and Talk Adapter Specifications.

DIAL AND VOICE	
Circuit:	Standard telephone.
DIMENSIONS	
Size:	Including cover, 11 in. w x 8 in. h x 10 in. d(279.4 mm w x 203.2 mm h x 254 mm d).
Weight:	Approximately 3 pounds (1.36 kg).

Table 2—3. Model TTS 37XPS Ac Power Supply Adapter Specifications.

POWER	
Output Voltage:	—48 volts dc.
Input Voltage:	115/230 volts ac at 50-60 Hz.
Maximum Load Current:	200 mA.
No-Load to Full-Load Regulation:	70 volts dc to 45 volts dc.
No-Load Output:	70 volts dc ± 6 Vdc with ripple less than or equal to 0.05 volt peak-to-peak.
Full-Load Output:	45 volts dc ± 3 Vdc with ripple less than or equal to 1.0 volt peak-to-peak.
Fuses:	0.5 A input, 0.2 A output.
DIMENSIONS	
Size:	Including cover, 11 in. w x 8 in. h x 10 in. d (279.4 mm w x 203.2 mm h x 254 mm d).
Weight:	Approximately 4 pounds (1.81 kg).

SECTION 3

INSTALLATION AND OPERATION

3.1 **INTRODUCTION.**

3.2 All necessary instructions for the Model TTS 37BRAQ installation are presented in paragraphs 3.3 and 3.4. Instructions for TTS 37BAQ/BRAQ test set operation begin with paragraph 3.5 while TTS 37BAQ cover accessory operation begins with paragraph 3.28.

3.3 **INSTALLATION.**

3.4 The Model TTS 37BRAQ is relay rack-mounted in a space 19 inches wide by 8-23/32 inches high by 6 inches deep (482.6 mm w x 221.5 mm h x 152.4 mm d). A terminal board is provided for −48 Vdc source connection to the test set. No special installation instructions are required for the Model TTS 37BAQ portable test set. Refer to Figure 3−2.

3.5 **OPERATION.**

3.6 Table 3−1 lists the TTS 37BAQ front panel controls, indicators and connectors with functions as illustrated on Figure 3−1. Tables 3−2 and 3−3 list the TTS 37XDT and TTS 37XPS cover accessory front panel controls, indicators anc connectors with functions as illustrated on Figure 3−3. Paragraphs 3.7 through 3.12 are general operating considerations while paragraphs 3.13 through 3.27 are detailed operating instructions for the Model TTS 37BAQ/BRAQ test sets. Paragraphs 3.28 through 3.32 are detailed operating instructions for the Models TTS 37XDT and TTS 37XPS cover accessories.

3.7 **GENERAL OPERATING CONSIDERATIONS.**

3.8 The test set can be powered from internal dry cell batteries or from −48 volt dc central office battery.

3.9 When the TTS 37BAQs cover is closed a projection inside the cover prevents the power switch from being left on. For this reason, and to protect the panel from damage, the cover should be closed when the test set is not in use.

3.10 Whenever POWER switch S1 is set to apply power to the test set, BATT TEST pushbutton S3, should be depressed to establish the battery condition or correct external power source connection. When the internal batteries are employed as a power source, a meter indication in the green sector marked GOOD indicates satisfactory battery voltage. When an extensive test series is being conducted with other than new cells, occasional checks of the internal battery voltage should be made to ensure continued satisfactory test results. When an external power source is used, an upscale meter indication in or near the GOOD sector verifies that correct polarity voltage has been applied. The test set will not be damaged by power supply polarity reversals. However, it will remain inoperative unitl the correct polarity voltage is applied to the power input connector.

3.11 Prior to power application to the test set, mechanical meter zero should be checked on meter M1. Ensure that the meter indicator is over the last left-hand mark at the meter scale end. If not, refer to Section 5, paragraph 5.9 for mechanical meter zero.

3.12 All connections, except for LINE binding posts J6 and J7, and the 48 volt jack J3 are 310-type jacks for ring and tip connection. 48 volt jack J3 is a 310-type jack tip for battery and sleeve for ground.

3.13 **DETAILED OPERATING PROCEDURE.**

3.14 **TO POWER THE TEST SET.**

3.15 The procedures listed below are provided to power the test set by internal battery supply use (TTS 37BAQ only). Refer to Figure 3−1 for front panel controls, indicators and connectors.

NOTE

The portable TTS 37BAQ has been calibrated with the meter in a horizontal position and the rack-mounted TTS 37BRAQ has been calibrated with the meter in a vertical position. To obtain specified accuracy the test set must be operated in the same position in which it was calibrated. To operate the test set in any other position, it must be recalibrated with the meter in the desired position.

Table 3—1. TTS 37BAQ Front Panel Controls, Indicators or Connectors.

REF DESIG	CONTROL, INDICATOR OR CONNECTOR	FUNCTION
E3	GND binding post	Allows connection to test set chassis ground.
J1	LINE jack	Provides access through a 310-type plug to receive circuitry as selected by S5 described below.
J2	DIAL jack	Allows connection of a dial or subscriber set to LINE jack J1 when INPUT switch S5 is in DIAL & TALK position.
J3	48V T = BATT S = GND jack	Allows central office battery connection to test set.
J4	AC MON jack	Allows telephone headset connection to monitor tone being measured.
J5	DC MON jack	Allows external dc monitor connection.
J6,J7	LINE binding post	Provide parallel connections to LINE, tip and ring using GR type connector.
S1	POWER ON/OFF switch	Connects internal batteries via J3 to test set while in ON position. If central office battery is connected to J3, connects external power source to test set.
S2	HOLD ON/OFF switch	When switch is ON, connects hold coil L1 across LINE jack and LINE binding posts.
S3	BATT TEST pushbutton switch	Connects meter M1 to battery test circuit.
S4	FILTER switch	Selects desired filter and average or quasi-rms detector to be presented to signal being measured.
S5	INPUT switch	Selects input circuit test function.
S6,S7	DBRN-VU-DBM SENS (1 dB and 10 dB step) switches	Allows gain adjustment of test set to obtain meter reading on M1.
S8	1010 Hz NOTCH FILTER switch (optional)	Inserts NOTCH FILTER in series with the 10 dB step attenuator and the first amplifier.

Table 3—2. Model TTS 37XDT Front Panel Controls, Indicators or Connectors.

REF DESIG	CONTROL, INDICATOR OR CONNECTOR	FUNCTION
—	Standard telephone dial	Allows dialing on a line connected to TTS 37BAQ.
S1	OFF-HOOK/ON-HOOK switch	Allows line seizure or release.
J1	LINE jack	Connects TTS 37XDT to TTS 37BAQ via DIAL jack J2.
J2,J3	TEL SET jacks	Allows headset connection to TTS 37XDT to talk and monitor line.

Table 3—3. Model TTS 37XPS Front Panel Controls, Indicators or Connectors.

REF DESIG	CONTROL, INDICATOR OR CONNECTOR	FUNCTION
F1	Fuse	Protects line from excessive current.
J1	48V jack	Allows connection from supply output to TTS 37BAQ 48V T = BATT S = GND jack J3.
J2	GND binding post	Allows connection to circuit ground.
P1	Ac line plug	Provides connection to ac line.
S1	POWER ON/OFF switch	In ON position, connects ac line source to power supply circuit.

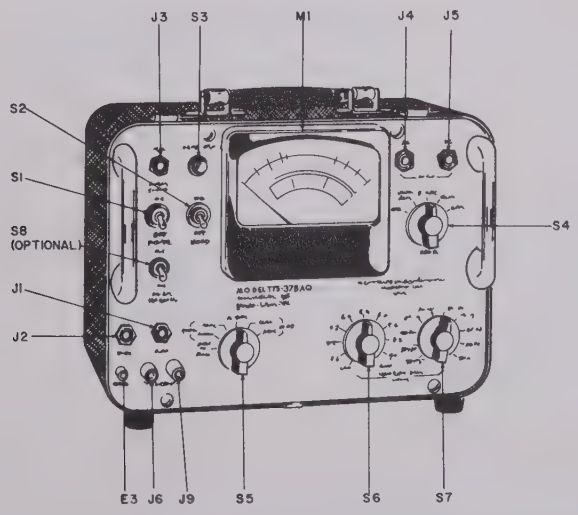

Figure 3—1. TTS 37BAQ Front Panel Connectors, Indicators and Indicators.

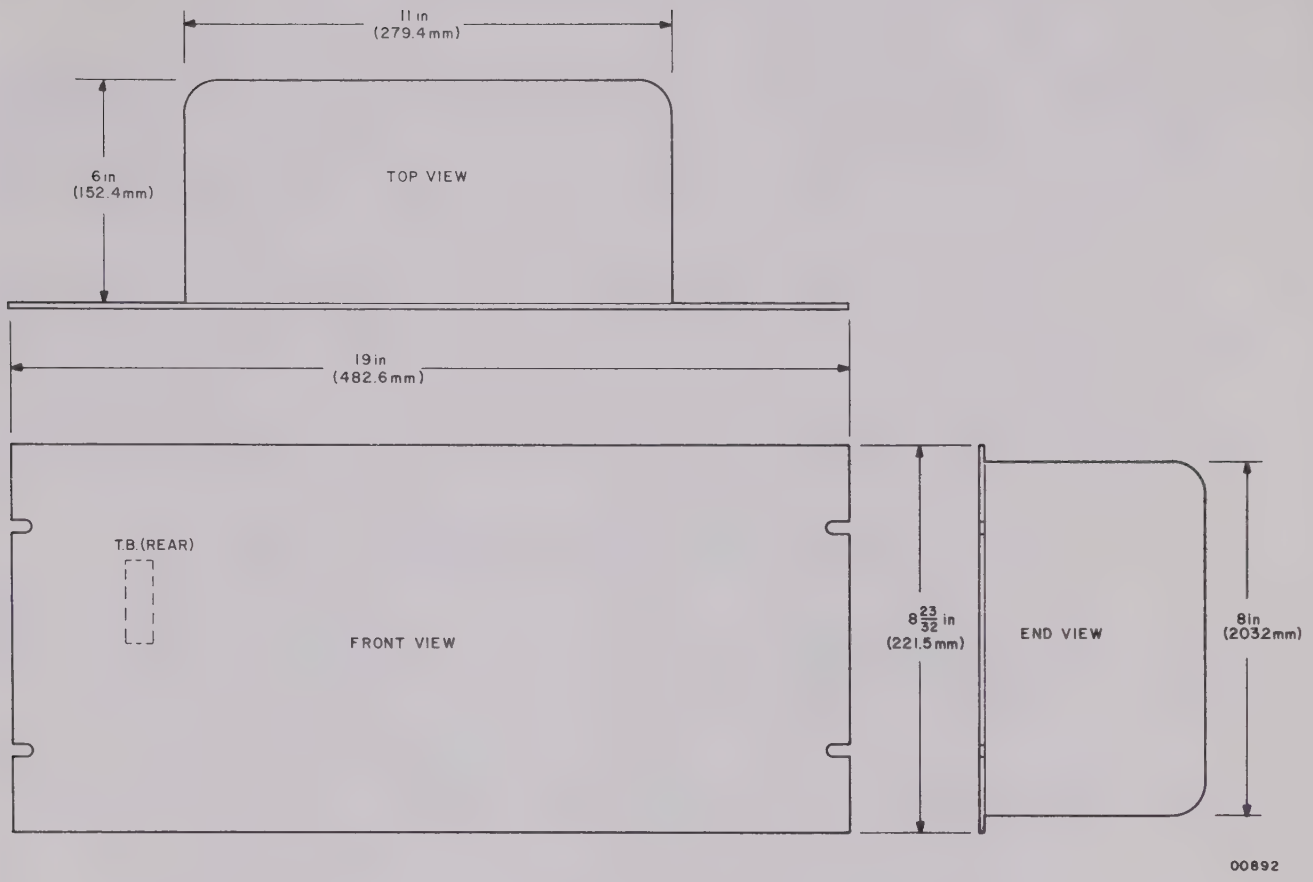

Figure 3—2. TTS 37BRAQ Installation Diagram.

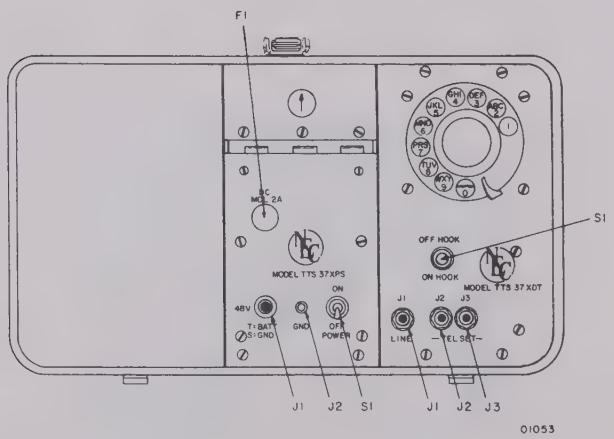

Figure 3—3. TTS 37XDT and TTS 37XPS Front Panel Connectors and Controls.

ACTION	RESULT
a. Turn POWER switch S1 to ON position.	Connects internal 18 volt battery supply to test set power circuit.
b. Depress BATT TEST pushbutton switch S3.	Connects meter M1 across power supply circuit as a voltmeter.
c. Read indication on meter M1.	If over green arc marked BATT TEST-GOOD, continue in procedures. If not, refer to Section 5, paragraph 5.7 for battery replacement.

3.16 The procedure listed below is provided to power the test set with an external 48 volt dc source (TTS 37BAQ/BRAQ).

CAUTION

Do not attach power source to power cord until the cord has been connected to the test set. Conversely, do not disconnect power cord from test set until power source has been turned off.

ACTION	RESULT
a. Run a 310-type tip and sleeve cord from 48V jack J3 to 48V central office battery. Apply tip to battery, sleeve to ground.	
b. Turn POWER switch S1 to ON position.	Connects external 48V source to test set power circuit.
c. Depress BATT TEST pushbutton switch S3.	Connects meter M1 across power supply circuit as a voltmeter.
d. Read indication on meter M1.	If over green arc marked BATT TEST-GOOD, continue in procedure. If not, reverse connections to external source and repeat steps c and d. If still no indication, refer to Section 5, paragraph 5.11.

3.17 **LEVEL MEASUREMENTS.**

3.18 The procedure below is provided to make level measurements with the TTS 37BAQ/BRAQ test sets.

ACTION	RESULT
a. Power test set as instructed in either paragraph 3.15 or 3.16.	
b. Set INPUT switch S5 to desired impedance and function.	Selects either 600-ohm or 900-ohm termination (TERM), bridge (BRDG) or noise-to-ground (N-GND).
c. Set FILTER switch S4 to black 15 KC (kHz) position.	15 KC (kHz) black panel marks select average dc value to be indicated on meter M1.
d. Connect circuit to be tested to either LINE jack J1 or LINE binding posts J6 and J7.	Connects test set to circuit under test.
e. Set SENS attenuator switches S6 and S7 to obtain a convenient indication on meter M1.	Level is algebraic sum of SENS switches (black numbers only) and meter indication (black numbers only.) Refer to Table 3—4 for level measurement examples.

NOTE

A more accurate measurement can be obtained if the meter needle falls between the black numerals +3 dBm and — 3 dBm.

Table 3—4. Level Measurement Examples.

SENS SWITCHES (black) setting dBm	METER READING (black numbers)	LEVEL dBm
+7	+ 2	+9
+15	—3	+12
0	—1.6	—1.6
—10	+2.4	—7.6
—15	—0.6	—15.6

3.19 To monitor the tone being measured insert a 310-type plug connected to a telephone headset into AC MON jack J4. This output can be connected to a 600-ohm impedance receiving device with little affect on the meter reading.

3.20 **NOISE MEASUREMENTS.**

3.21 The procedure listed below is provided to make noise and noise-to-ground measurements.

ACTION	RESULT
a. Power test set as instructed in either paragraph 3.15 or 3.16.	
b. Set INPUT switch S5 to desired impedance and function.	Selects either 600-ohm or 900-ohm termination (TERM), bridge (BRDG) or noise-to-ground (N-GND).
c. Set FILTER switch S4 to blue 15 KC (kHz) position.	15 KC (kHz) blue panel marks select quasi-rms values to be indicated on meter M1.
d. Set SENS switches S6 and S7 to 85 dBrn (blue numbers).	
e. Connect circuit to be tested to either LINE jack J1 or LINE binding posts J6 and J7.	Connects test set to circuit under test.
f. Reset SENS switches to obtain an indication between 7 dBrn and 13 dBrn (blue numbers only).	Noise reading is algebraic sum of SENS switches and meter M1 indication (blue numbers). Refer to Table 3—5 for examples.

NOTE

When recording noise measurements, filter type used should be indicated, such as "42 dBrn - C-msg" or 95 dBrn - 15 KC (kHz) Flat".

ACTION	RESULT
g. To make noise-to-ground measurements, set INPUT switch S5 to N-GND and connect a good ground to GND binding post E3.	
h. Set filter switch S4 to any blue position. C-MSG position is normally used for noise-to-ground measurements.	C-MSG position selects C-message weighted quasi-rms values to be indicated on meter M1.
i. Set SENS switches S6 and S7 to 85 dBrn (blue numbers).	
j. Connect circuit to be tested to either LINE jack J1 or LINE binding posts J6 or J7.	Connects test set to circuit under test.
k. Reset SENS switches S6 and S7 to obtain an indication between 7 dBrn and 13 dBrn (blue numbers.	Noise indication is algebraic sum of SENS switches and meter M1 indication (blue numbers). Refer to Table 3—5 for noise measurement examples.

Table 3—5. Nosie Measurement Examples.

SENS SWITCHES dBrn	METER READING dBrn	NOISE LEVEL dBrn
27	7	34
35	10	45
22	12	34

3.22 To monitor the noise being measured, insert a 310-type plug connected to a telephone headset into AC MON jack J4. This jack can be connected to a 600-ohm impedance device with little affect on meter indications.

3.23 **VU MEASUREMENTS.**

3.24 The following procedure is provided to make VU measurements on Models TTS 37BAQ/BRAQ test sets.

ACTION	RESULT
a. Power test set as instructed in either paragraph 3.15 or 3.16.	
b. Set INPUT switch S5 to desired impedance and function.	Selects either 600-ohm or 900-ohm termination (TERM), bridge (BRDG) or noise-to-ground (N-GND).
c. Set FILTER switch S4 to black 15 KC (kHz) position.	15 KC (kHz) black panel marks select average dc values to be indicated on meter M1.
d. Connect circuit to be tested to either LINE jack J1 or LINE binding posts J6 and J7.	Connects test set to circuit under test.

ACTION	RESULT
e. Set SENS switches S6 and S7 to obtain a reference point using the black numbers.	
f. Meter needle deflection into green (0 dB to +3 dB) and yellow (−6 dB to 0 dB) or red (−15 dB to −6 dB) arcs can now be noted.	Indicates VU measurements on meter M1.

3.25 **TO DIAL AND TALK ON CIRCUIT UNDER TEST.**

ACTION	RESULT
a. Set INPUT switch S5 to DIAL & TALK.	Connects LINE jack J1 and LINE binding posts J6 and J7 to DIAL jack J2.
b. Connect dial or subscriber set equipped with dial to DIAL.	A number can be dialed on circuit connected to LINE inputs.

NOTE

Circuit under test must supply the necessary dc talk battery.

3.26 **TO HOLD AND RELEASE.**

ACTION	RESULT
a. Set HOLD switch S2 to ON position.	Adds hold coil L1 across LINE jack J1 and LINE binding posts J6 and J7. This will hold a circuit connected to LINE inputs when INPUT switch S5 is in any position.
b. Set HOLD switch S2 to OFF position.	Removes hold coil L1 from INPUT circuits to release LINE.

NOTE

The hold coil can be influenced by strong magnetic fields. This normally occurs in more sensitive positions. Test set relocation away from the field, or operation on HIGH PASS or C-MSG filters will reduce the effect.

3.27 **TO DC MONITOR OR RECORD.**

ACTION	RESULT
a. Follow normal procedure under either paragraph 3.17 to record average dc values, or paragraph 3.20 to record quasi-rms values.	

ACTION	RESULT
CAUTION **The external dc monitor (recorder or meter) device must have a relatively low resistance (not exceeding 300 ohms) and must be isolated from ground.**	
b. Connect monitor device to DC MON jack J5, tip and ring.	If monitor device has correct resistance, there will be no change in reading on meter M1.
c. Calibrate external monitor.	0 dB meter reading will produce approximately 0.7 mA output.

3.28 **MODEL TTS 37BAQ COVER ACCESSORIES.**

3.29 **MODEL TTS 37XDT OPERATING PROCEDURES.**

3.30 The following procedures provide instructions for the Model TTS 37XDT Dial and Talk Adapter operation.

ACTION	RESULT
a. Patch a 2-wire ring and tip cord from DIAL jack J2 on TTS 37BAQ to LINE jack J1 on TTS 37XDT.	Connects TTS 37XDT to LINE when INPUT switch S5 is in DIAL AND TALK position.
b. Connect a 52A headset to TEL SET jacks with with J2 to transmitter, J3 to receiver.	TTS 37XDT is set to talk or monitor on LINE as required.
c. Set OFF-HOOK/ON-HOOK switch S1 to OFF-HOOK.	Seizes LINE.

3.31 **MODEL TTS 37XPS OPERATING PROCEDURE.**

3.32 The following procedure provides instructions to power the Model TTS 37BAQ with the TTS 37XPS Power Supply Adapter.

ACTION	RESULT
CAUTION **Do not connect ac line cord until POWER switch S1 is in the OFF position and the TTS 37XPS is connected to the TTS 37BAQ. Conversely, do not disconnect the power cord from the TTS 37BAQ until the TTS 37XPS POWER switch S1 is turned OFF or the ac line cord is disconnected.**	
a. Connect a power cord 310-type tip and sleeve connections from TTS 37BAQ −48V jack J3 to TTS 37XPS −48V jack J1.	Connects TTS 37BAQ power circuitry to power supply circuit of TTS 37XPS.

ACTION	RESULT
b. Connect ac plug P1 to 115 V ac source.	Provides a supply source for power supply circuit.
c. Set POWER switch S1 to ON and follow procedure outlined in paragraph 3.16 for −48V operation.	TTS 37BAQ now ready to operate by use of ac line.
d. To power down the TTS 37BAQ, reverse above procedure.	

SECTION 4

CIRCUIT DESCRIPTION

4.1 INTRODUCTION.

4.2 Circuit descriptions and the diagrams in this section, along with the schematic diagrams in Section 7, provide all necessary operational principles for a thorough understanding of the Models TTS 37BAQ/BRAQ and accessories. A block diagram description outlines the overall functions and relationships of the major assemblies and begins with paragraph 4.4. The detailed schematic diagram description elaborates on the functions and relationships within each assembly and begins with paragraph 4.30.

4.3 GENERAL DESCRIPTION.

4.4 The test set gain is obtained from two amplifiers and a detector/amplifier. Each amplifier or detector-amplifier is enclosed with a large amount of negative feedback to ensure gain stability. The inherent noise level of the set is at least −110 dBm and approaches −120 dBm when the C-message filter is used. For ease of discussion, the unit is divided into the basic assemblies listed below. Refer to Figure 4−1 for the overall block diagram.

a. Input Circuit

b. Attenuator Circuits

c. Switching Circuits

d. Filter Circuits

e. Amplifier/Detector Circuits

f. Monitor Circuits

g. Power Circuit

h. Accessories

4.5 INPUT CIRCUIT.

4.6 The circuit under test is connected to the test set at the input jacks. Internal line connections are made via INPUT switch S5. This switch selects the particular line test function to be supplied. These are DIAL & TALK, 600-ohm or 900-ohm termination (TERM) 600-ohm or 900-ohm bridge (BRDG) or noise-to-ground (N-GND). The line is then coupled via input transformer T1 to the 10 dB step attenuator. T1 has a ± 150 volt dc blocking capability.

4.7 ATTENUATOR CIRCUITS.

4.8 These attenuators adjust the received signal sensitivity to a useable level. The 10 dB attenuator is an L-pad series. The 1 dB attenuator is a conventional voltage divider.

4.9 SWITCHING CIRCUITS.

4.10 Filter switch S4 performs two distinct switching functions. These are filter selection and average or quasi-rms detector selection. The filter selection provides the desired frequency response. The average or quasi-rms selection determines the type of output to the meter circuit. In the 15 KC (kHz) and HIGH PASS (black lettered) positions, the average detector is inserted between amplifier 2 and the meter circuit. In the 15 KC (kHz), C-MSG and 3 KC (kHz) (blue lettered) positions, the quasi-rms detector is inserted between amplifier 2 and the meter circuit.

4.11 FILTER CIRCUITS.

4.12 The 15 Kc (kHz), HIGH PASS, C-MSG, or 3 KC (kHz) filter selection is made with front panel switch S4. The optional 1010 Hz notch filter is inserted with optional switch S8 and can be used in conjunction with any of the other filter modes. The C-MSG filter and the HIGH PASS filter produce the response curves illustrated on Figure 2−1. The 3 KC (kHz) and 15 KC (kHz) filters produce the response shown on Figure 2−2. The filter insertion loss is approximately 12 dB. Once the overall gain has been set by calibrating the 15 KC (kHz) function, the remaining filters are normalized to the 15 KC (kHz) position. The optional 1010 Hz notch filter produces the response curve illustrated on Figure 2−3. Unwanted tones that occur in the band of 995 Hz to 1025 Hz are attenuated at least 50 dB.

4.13 AMPLIFIER/DETECTOR CIRCUITS.

4.14 Amplifiers 1 and 2 are three-stage, common-emitter circuits and have a high gain and high input impedance. Amplifier 1 output impedance is approximately 600 ohms to match the filter circuit input impedance.

4.15 AVERAGE DETECTOR.

4.16 This is a two-stage amplifier that drives a complementary transistor pair. These transistors rectify the sinusoidal signal similar to a diode bridge. The use of transistors in place of diodes provides current gain and

allows a greater dynamic range.

4.17 **QUASI-RMS DETECTOR.**

4.18 This section has two amplifiers, a rectifier circuit and a gain-adjustment network. It converts the sinusoidal signal output of amplifier 2 to dc current quasi-rms values to be used in the meter circuit. It also provides output signals for the ac and dc monitor circuits.

4.19 **MONITOR CIRCUITS.**

4.20 Dc Monitor Circuit. DC MON jack J5 provides access to connect an external milliammeter or recorder in series with the test set meter. The average detector characteristics, along with the bridge incorporated in the feedback loop, produce a high-impedance or constant-source for the meter. For this reason, the external device connected to the DC MON jack can have a wide resistance range. To ensure maximum reading accuracy it is advisable to keep this external device resistance below 300 ohms. Since a part of the feedback would be shorted out, it is also necessary to keep this device electrically isolated from ground. Whenever the meter reads 0 dBm, the available current is approximately 0.7 milliamperes.

4.21 Ac Monitor Circuit. The ac monitor circuit consists of Q211 for the average detector and Q8 for the quasi-rms detector. These transistors, selected by the FILTER position of switch S4, amplify the signal and provide a given impedance source available at AC MON jack J4. This sinusoidal signal is still a direct function of the signal at the LINE jacks. To conserve internal battery power, the Q211 and Q8 collector supplies are normally cut off until a plug is inserted into AC MON jack J4. The signal available at this jack is dc-blocked so that a dc resistance can be inserted between the jack tip and ground. If any dc voltage should be applied to the tip of AC MON jack J4, it should not exceed the limits of −9 volts to +12 volts.

4.22 **POWER CIRCUIT.**

4.23 The set operates from two power sources. These are either an 18 volt internal battery or a −48 volt external source. The TTS 37BRAQ operates only from a −48 volt external source. Access to −48 volt jack J3, removes the 18 volt internal battery from the power circuit. Jack J3 is diode protected to prevent damage to the internal circuitry in case the voltage is applied in reverse polarity.

4.24 **TTS 37BAQ ACCESSORIES.**

4.25 TTS 37XDT Dial and Talk Adapter. The TTS 37XDT has a standard dial, talk coil and jacks to allow a line under test to be dialed or monitored.

4.26 TTS 37XPS Ac Power Supply Adapter. The Model TTS 37XPS has protective fuses for both the ac line and the −48 volt output. It has an ac-line transformer, a full-wave diode bridge rectifier and a dc filter to provide a steady source for the power circuitry in the TTS 37BAQ.

4.27 **DETAILED CIRCUIT DESCRIPTION.**

4.28 **INPUT CIRCUIT.**

4.29 Line jack J1, hold coil L1, INPUT (function) switch S5 and transformer T1 along with associated resistors and capacitors (Figure 7−1) comprise the input circuit. The input line connections are made to balanced transformer T1. Capacitor C101, a dc blocking capacitor, is in series with the windings of transformer T1. Termination resistors for 600-ohm and 900-ohm input impedances can be switched directly across the input line without loss of dc blocking. These resistors and hold coil L1 can be placed across the line and are switched at the equal-potential (center-tapped) position to maintain balance. This balance is at least 80 dB at 60 Hz, 70 dB at 1000 Hz and better than 60 dB at up to 10 kHz. A longitudinal drain with a center-tap connected to ground via resistor R103 is included. Transformer T1 has approximately a 1:1 ratio. Since its secondary is loaded by a high impedance, the primary also relfects this impedance. This is seen in the bridge (BRDG) position of INPUT switch S5. It is nominally 12,000 ohms for 600-ohm circuits and 15,000 ohms for 900-ohm circuits. The bridging losses will be less than 0.2 dB for frequencies down to approximately 100 Hz.

4.30 INPUT Switch Functions. In the DIAL & TALK position of INPUT switch S5, the tip and ring of J2 is reversed and connected to LINE jack J1 and LINE binding posts J6 and J7. In the 900-ohm BRDG position, bridge resistors R101 and R106 are added across the LINE inputs. The LINE input is then coupled across transformer T1 and dc-blocking capacitor C1. The 900-ohm TERM position adds termination resistors R105 and R108 to the circuit. In the 600-ohm BRDG and TERM positions, R104 is removed from the balanced transformer output. The 600-ohm TERM position also adds termination resistors R107 and R109 to the circuit. With INPUT switch S5 in the N-GND position, all termination resistors are removed from the circuit. The

output from the INPUT switch applied to the 10 dB step attenuator is taken from the longitudinal drain between R102 and R103. The center-tapped longitudinal drain, comprised of resistors R102 and R103, is inserted between resistors R101 and R106.

4.31 Hold coil L1 is added across the LINE inputs by HOLD switch S2. The low-resistance hold coil is used to hold the line.

4.32 **10 DB STEP ATTENUATOR.**

4.33 This attenuator is the main sensitivity adjustment. It allows 90 dB of attenuation, in 10 dB increments, to be switched into the circuit prior to amplifier 1. Refer to Figure 7—1. It consists of 5 L-pads. One pad, R1 and R2, has 50 dB of loss. The remaining four pads have 10, 20, 30 and 40 dB of loss respectively. The —60 through —20 dB switch positions are 2 pads in series. To ensure a ± 0.15 dB attenuation accuracy, 0.5% resistor tolerances are used in the network. Refer to Table 4—1 for 10 dB step attenuator resistors.

Table 4—1. 10 DB Step Attenuator Resistors.

SWITCH POSITION	RESISTORS	NO. OF PADS	LOSS (DB)
—70	R10	—	0
—60	R9,R14	1	10
—50	R7,R8,R13	1	20
—40	R5,R6,R12	1	30
—30	R3,R4,R11	1	40
—20	R1,R2,R10	1	50
—10	R1,R2/R9,R14	2	10+50
0	R1,R2/R7,R8,R13	2	20+50
+10	R1,R2/R5,R6,R12	2	30+50
+20	R1,R2/R3,R4,R11	2	40+50

4.34 **OPTIONAL 1010 HZ NOTCH FILTER.**

4.35 The 1010 Hz passive notch filter is inserted into the circuit in conjunction with any of the other filter modes by switch S8. The notch filter is added after the 10 dB step attenuator and before the first amplifier. It is used to measure noise when a tone is present. The filter provides a minimum of 50 dB of rejection in series with a C-message filter to permit noise-with-tone measurements.

4.36 The 1010 Hz band-reject notch filter has an unbalanced input designed to work with an input-impedance of 600 ohms and an output-impedance of 600 ohms. The input of the notch filter board is a high-impedance buffer amplifier. The output is a two-stage amplifier that compensates for the insertion loss of the band-reject filter into an output of 20,000 ohms.

4.37 **AMPLIFIER 1.**

4.38 The three-stage, common-emitter amplifier; comprised of transistors Q201, Q202 and Q203; has a voltage gain of approximately 30 dB. The output impedance of approximately 600 ohms matches the filter input-impedance. Refer to Figure 7—1. The input to amplifier 1, from 10 dB SENS switch S7 via dc-blocking capacitor C201, is applied to the base of transistor Q201. The collector of Q201 is R-C coupled to the base of transistor Q202. Resistor R207 provides the feedback path from the emitter of Q203 to the emitter of Q201. This stabilizes the gain of amplifier 1. Resistor R208 serves as a series resistance to build up the output-impedance to approximately 600 ohms to match the filter input impedance. Power to amplifier 1 is supplied from the —12 volt power section and is applied through resistor R251. Capacitor C204 serves as a filter capacitor for this power buss.

4.39 **FILTERS AND SWITCHING NETWORK.**

4.40 The filter-switching network is a five position rotary switch and associated resistors, capacitors and inductors. It selects the proper components that produce the response curves shown in Figures 2—1 and 2—2. The insertion loss is approximately 12 dB. The overall gain of the set is calibrated with the 15 KC (kHz) filter switched in and with the average detector selected. This position has no provision for loss

adjustment. Once the overall gain of the set has been established, the remaining filters are alternately selected, and with the potentiometers provided, each filter loss is normalized to that of the 15 KC (kHz) position.

4.41 **1- DB STEP ATTENUATOR.**

4.42 This is a conventional stepped voltage divider network that presents a 600-ohm impedance to the filter network and is terminated by the high-impedance of amplifier 2. To ensure a ± 0.15 dB attenuation accuracy, 0.5% resistor tolerances are used in this network. It provides a 10 dB attenuation range in 1-dB increments.

4.43 **AMPLIFIER 2.**

4.44 Amplifier 2 is a three-stage, common-emitter amplifier that has a voltage gain of approximately 50 dB. This amplifier comprised of transistors Q204, Q205 and Q206; has an input-impedance greater than 30,000 ohms. Any change in the 1-dB step attenuator output impedance is negligeable when changing attenuator steps. Stages are RC-coupled except for the Q205 output that is directly coupled to the base of Q206. Capacitors C219,C1, and C223 serve as dc blocking capacitors between the input and output stages respectively. Negative feedback is taken from the emitter of Q206 and applied to the emitter of Q204. The average detector output is taken from the collector of Q206. The emitter of Q206 has a large dc resistance to provide the proper base current. Most of this resistance is bypassed by capacitor C222 so that degeneration at signal frequencies will not occur in this stage. Unbypassed emitter resistor R225 provides overall loop feedback to stabilize the amplifiers gain.

4.45 **AVERAGE DETECTOR/QRMS DETECTOR SWITCHING NETWORK.**

4.46 This network uses two additional decks from FILTER switch S4 to accomplish the switching functions. In the 15 KC (kHz), 3KC (kHz) or C-MSG (blue) positions, the amplifier 2 output at the collector of Q206 is applied to the quasi-rms detector input via resistor R1 and capacitor C1 to base of transistor Q1. In the 15 KC (kHz) or HIGH PASS (black) positions, the amplifier 2 output is coupled via C223 to the average detector base of transistor Q207. One deck of FILTER switch S4 selects either the average detector or the quasi-rms detector output and applies it to the meter circuit via BATT TEST switch S3.

4.47 **QUASI-RMS DETECTOR.**

4.48 Audio at the quasi-rms detector input is amplified by transistors Q1 and Q4. Refer to Figure 7—2. Bootstrap amplifier Q2 provides isolation for this amplifier by increasing the impedance at the collector of Q4. Transistors Q3,Q5, Q6 and Q7 form a full-wave rectifier circuit to convert the audio signal to quasi-rms values for measurement by meter M1. The overall quasi-rms detector circuit sensitivity is – 20 dB. Capacitors C7 and C8 recombine the rectified output for use in gain adjustment network R17 and tone monitor amplifier Q8.

4.49 **AVERAGE DETECTOR.**

4.50 This circuit is a two-stage, common-emitter amplifier comprised of transistors Q207 and Q208, and a detector comprised of transistors Q209 and Q210. Refer to Figure 7- 1. Bias for the amplifier stages is derived from the collectors for dc stabilization. The output of these amplifiers drive the complimentary transistor pair consisting of Q209 and Q210. This pair acts like a diode bridge and rectifies the sinusoidal signal to provide emitter current on each half-cycle used to drive the meter circuit. The pair output is recombined by capacitors C226, C227 and resistors R238, R239 to form a sinusoidal signal that provides negative feedback to Q207. In addition, this signal provides an output for the AC MON circuit via C228. Gain adjustment is provided by the network comprised of resistors R234, and R233. It controls the amount of feedback applied to amplifier stage Q207.

4.51 **METER CIRCUIT.**

4.52 The average detector output from transistors Q209 and Q210, or the quasi-rms detector output from transistors Q6 and Q7 drives meter M1 via BATT TEST pushbutton switch S3. When S3 is depressed, meter M1 is removed from the output circuits and connected between the internal battery and ground via dropping resistor R244. This converts the dc milliammeter into a voltmeter to monitor the battery condition or to check the polarity of the external dc source.

4.53 **MONITOR CIRCUITS.**

4.54 Dc Monitor Circuit. J5 is the dc monitor output jack. It is connected in series with meter M1 and provides a dc current of approximately 0.7 milliampere when the external device resistance is less than 300 ohms. Since J5 is connected in series with the meter and detector output, the device connected to it must not be connected to ground since any feedback to the circuits will be shorted.

4.55 Ac Monitor Circuit. The ac monitor circuit, transistor Q211 for the average detector and transistor Q8 for the quasi-rms detector, are common-emitter

configurations and amplify the recombined signal taken from the selected detector output via FILTER switch S4. The collector supply for Q8 and Q211 is wired via AC MON jack J4 in a manner that leaves it disconnected until a plug is inserted into the jack. The output from Q8 is dc-blocked by C12 while the Q211 output is dc-blocked by C229. This allows a dc voltage to be applied to the tip of AC MON jack J4. This voltage should not exceed −9 volts or +12 volts dc.

4.56 **POWER SECTION.**

4.57 The unit operates from one of two power sources. These are the 18 volt internal batteries or an external −48 volt dc source. When operating from a −48 volt dc source, the internal battery is disconnected from the regulator by −48V jack J3. The 48 volts is then applied to −24 volt regulator diode CR203. The output of this circuit is then applied to the −12V regulator circuit to provide power for the unit.

4.58 **VOLTAGE REGULATOR.**

4.59 A voltage regulator is supplied with the optional 1010 Hz Notch Filter. The regulator of units modified to accept the 1010 Hz Notch Filter is mounted on its own printed circuit board (96643). The board is attached to the main printed circuit board (95695). In present units the voltage regulator is incorporated into the main printed circuit board.

4.60 The −18 volt supply is applied across resistor R1 and zener diode CR1. Resistor R1 supplies the reference current to the 5.6 volt reference zener of comparator U1 at pin 3. Any change in the output voltage is sensed by the voltage divider comprised of resistors R3 and R4. The voltage across R4 is applied to the input of comparator U1 at pin 2. The voltage difference at the output of U1 is applied through transistor Q1 to current limiting transistor Q2. Resistor R2 provides short circuit protection.

4.61 **TTS 37BAQ ACCESSORIES.**

4.62 TTS 37XDT Dial and Talk Adapter. An external 52A headset is connected to the TTS 37XDT standard dial and talk coil circuit S1 via J1 and J2. Refer to Figure 7−1. On-hook off-hook switch S1 is provided to seize the line. Line connections are made via LINE jack J1.

4.63 TTS 37XPS Ac Power Supply Adapter. Ac plug P1 connects the 115 or 230 volt 50 Hz or 60 Hz ac line voltage to POWER switch S1. S1 then applies this voltage to the ac line transformer T1 primary via fuse F1. Refer to Figure 7−5. For 115V operation, resistor R220 is omitted. For 230V operation, resistor R220 must be in the circuit to drop the excess primary voltage. Resistor R220 should be at least a 2,000-ohm, 5-watt resistor. The secondary voltage from T1 is applied to the full-wave diode bridge rectifier circuit comprised of CR1 through CR4. Then it is applied to the two section RC filter comprised of resistors R1,R2, and capacitors C1 and C2. The filter output is protected by fuse F2 and applied to −48V jack J1.

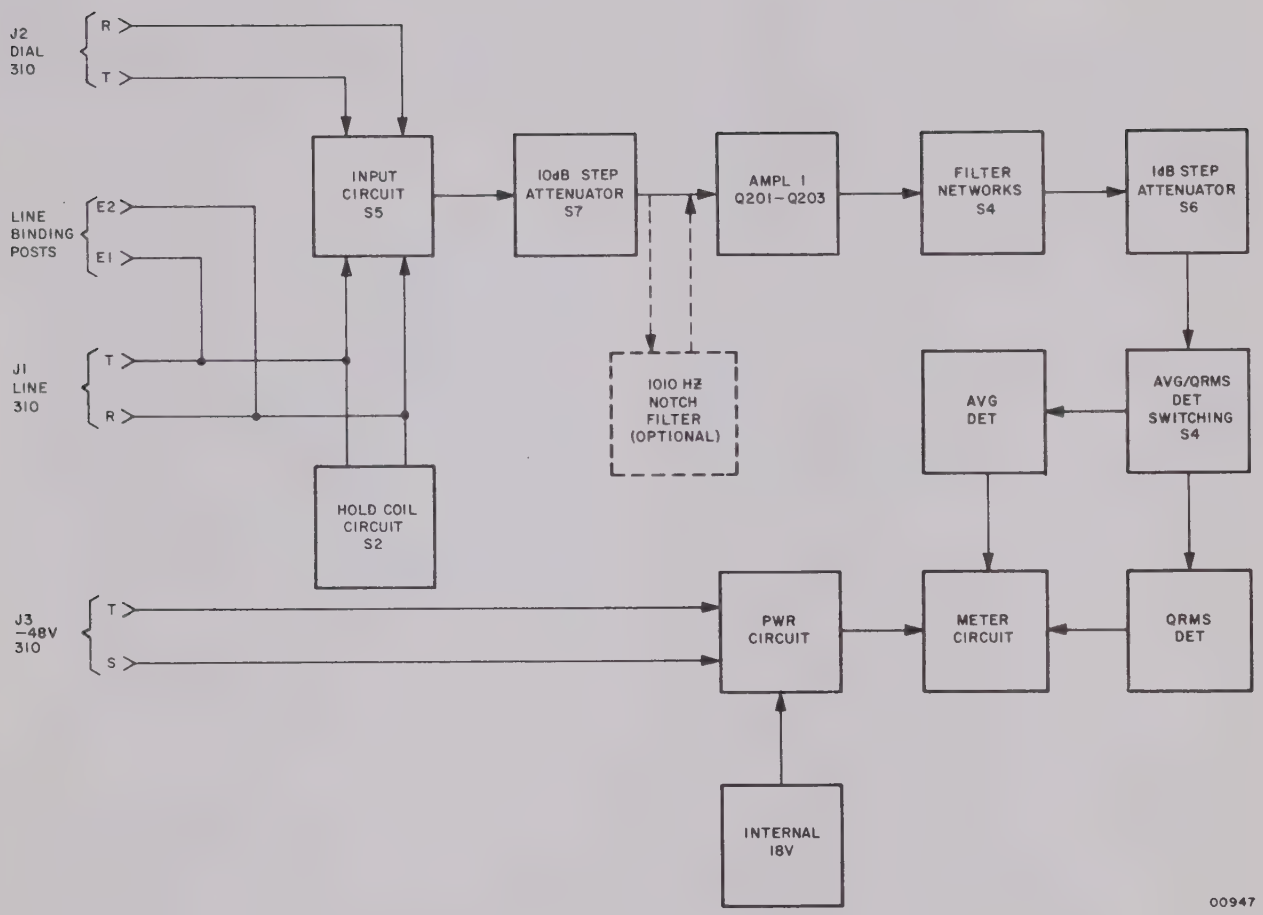

Figure 4—1. TTS 37BAQ Overall Block Diagram.

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SECTION 5

MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION.

5.2 The Model TTS 37BAQ/BRAQ maintenance procedures are listed in paragraphs 5.5 through 5.10. Calibration procedures are provided in paragraphs 5.21 and 5.22. Paragraphs 5.3 and 5.4 list and describe necessary test equipment and paragraphs 5.11 through 5.20 provide a trouble analysis procedure. Calibration should not be attempted by personnel who are not familiar with test set purpose and operation.

5.3 REQUIRED TEST EQUIPMENT.

5.4 The test equipment list below is the minimum required for TTS 37BAQ/BRAQ test set calibration.

a. Ac and dc voltmeter with a 20,000 ohms-per-volt minimum input resistance.

b. Signal source with a 600-ohm and 900-ohm output impedance, and able to develop a 1-milliwatt output signal into 600 ohms and 900 ohms at a 1 kHz frequency. Output level tolerance must be ± 0.1 dB.

c. Oscilloscope with a 100 millivolt-per-centimeter minimum sensitivity at 100 kHz.

5.5 MAINTENANCE.

5.6 The paragraphs below list routine maintenance such as mechanical meter zero, battery replacement and preventive maintenance.

5.7 BATTERY REPLACEMENT.

5.8 If meter M1 indicates that the batteries are low i.e., an indication in other than the green arc marked BATT TEST-GOOD, replace the batteries as follows:

a. Loosen four captive screws on front panel, then remove test set from case.

b. Disconnect red and black wires from batteries.

c. Remove battery retainer plate.

d. Remove old batteries and, observing correct polarity, replace with new ones.

e. Return battery retainer plate to its correct position and reconnect red and black wires to batteries.

f. Turn POWER switch S1 to ON and check batteries by depressing BATT TEST pushbutton switch S3. Meter M1 should indicate GOOD in green arc.

g. If batteries check out good, replace set in case and tighten four captive screws on front panel.

5.9 METER ZERO ADJUSTMENT.

NOTE

POWER switch S1 should be OFF for zero adjustment. On the portable model, adjustment should be made with the test set in the desired position of use.

5.10 Meter zero adjustment is accomplished by rotating the screw on the bottom-front meter case until the indicator needle is directly over the last scale mark on the left. Adjust from off-scale to zero. Do not adjust from on-scale to zero.

5.11 TROUBLE ANALYSIS.

5.12 By use of the test equipment described in paragraph 5.4, the schematics in Section 7, the voltage values listed in Table 5—2, and with the procedures below, a qualified technician should have no difficulty in Model TTS 37BAQ/BRAQ test set trouble analysis.

5.13 Before an assumption is made that there is a fault in the test set, and in the event of an inaccurate or missing meter indication, the procedures below should be followed.

a. Check batteries. When BATT TEST pushbutton S3 is depressed, meter should indicate GOOD in green arc. If not, replace batteries as indicated in paragraph 5.7.

b. Check for correct control settings as follows:

1. HOLD switch S2 is set to desired position.

2. INPUT switch S5 is set to desired position.

3. SENS switches S6,S7 sufficiently sensitive to give a reading on meter M1.

4. INPUT signal connected to proper jack or terminals (preferably at 1 kHz frequency).

5. If DC MON is in use, device connected to it has a low dc resistance.

6. FILTER switch S4 is set to desired position.

c. If all controls are set correctly and battery check is good but meter indication is still faulty, internal circuits should now be checked with the procedures listed below.

5.14 **CIRCUIT CHECK.**

5.15 The procedures below, when used with the information provided in Tables 5—1, 5—2 and the schematic diagrams in Section 7, provide a method for trouble isolation in the Model TTS 37BAQ/BRAQ.

5.16 Input Circuit Check. Remove the test set from the case by removal of the four captive screws on the front panel and proceed as follows:

a. Set SENS switch S7 to —70 dBm.

b. Set INPUT switch S5 to either 600 TERM or 600 BRDG position.

c. Set POWER switch S1 to OFF position.

d. Connect a 1 kHz, 0 dBm signal from signal source to LINE jack J1.

e. With VTVM or oscilloscope, check for approximately 2 volts peak-to-peak at transformer T1 pin 7. Refer to Table 5—2. Same signal should also appear at INPUT switch S5 deck 2A wiper and SENS switch S7 deck 1 wiper. This signal should appear at base of transistor Q201 (PC1 pin 24).

5.17 Amplifier 1 Check.

a. Set POWER switch S1 to ON.

b. Set SENS switch S7 to —40 dBm.

c. Connect oscilloscope to PC1 pin 23 amplifier 1 output. Level at this point should be approximately 1.5V peak-to-peak. If there is a very low output, or no signal, continue below.

CAUTION

When dc voltage checks are made, use a VTVM (20,000 ohm-per-volt) on 10V scale.

d. Remove signal from INPUT terminals and measure dc voltages at collectors of Q201, Q202 and at emitter of Q203. Refer to Figure 7—1.

Table 5—1. Symptom Reference List.

SYMPTOM	PROBABLE FAULT OR LOCATION
BATT TEST incorrect (internal battery operation)	a. Aged batteries.
BATT TEST incorrect (external source operation)	a. External source connected in reverse polarity. b. Incorrect voltage from external source.
No meter indication	a. Faulty connections. b. Improper control settings. c. Lack of power to test set. d. Inoperative internal circuit.
Meter indication but no ac monitor output	a. Average detector Q211. b. Quasi-rms detector Q8.

Table 5—2. Voltage Checks.

CIRCUIT	LOCATION OF TEST POINT	READING
Input	T1, pin 7	2V ac peak to peak
	INPUT S5, deck 2A wiper	2V ac peak to peak
	SENS S7, deck 1 wiper	2V ac peak to peak
	PC1, pin 24 (base of Q201)	2V ac peak to peak
Amplifier 1	PC1, pin 23 (Amp 1 output)	1.5V ac peak to peak
	Q201 collector	−2V dc
	Q202 collector	−6V dc
	Q203 emitter	−5V dc
Filter	PC1, pin 9	0.3V ac peak to peak
Amplifier 2	Q206 collector	0.4V ac peak to peak
	Q206 emitter	−4V dc
	Q204 collector	−5V dc
	Q205 collector	−4V dc
Average detector	Q208 collector	2V ac peak to peak
	Q207 collector	−5V dc
	Q208 collector	−5V dc
All voltage checks made with reference to dc ground. Ac checks made with a 1 kHz input signal at 0 dBm. All checks are approximate values.		

5.18 Filter Check.

a. Connect a 1 kHz, 0 dBm signal to INPUT terminals. Set SENS switch S7 to −40 dBm and SENS switch S6 to −10 dBm.

b. Connect oscilloscope to PC1 pin 9. Signal should be approximately 0.3 volt peak-to-peak.

5.19 Amplifier 2 Check. If the checks in paragraph 5.14 through 5.18 above are satisfactory, proceed as follows:

a. Set both SENS switches S6, S7 to 0 dBm position.

b. With oscilloscope or VTVM, check level of transistor Q206 at collector. This should be approximately 0.4 volt peak-to-peak.

c. If this voltage is incorrect, check dc voltages in same manner as described in paragraph 5.17 above and observe CAUTION under that paragraph.

5.20 Average Detector Check. This circuit is checked in the same manner as amplifier 2. The level at the collector of Q208 should be approximately 2V peak-to-peak and should be flattened in appearance. When a check is made of the dc voltages, observe the CAUTION under paragraph 5.17.

5.21 **CALIBRATION.**

5.22 If test set calibration is required, perform the following procedure with equipment from the list in paragraph 5.3.

a. Remove test set from case after four captive screws that secure front panel are loosened.

b. Perform meter zero adjustment as outlined in paragraph 5.9.

c. Set front panel controls as follows:

1. INPUT switch S5 to TERM 600 position.

2. HOLD switch S2 to OFF position.

3. POWER switch S1 to ON position.

4. SENS switches S6, S7 to 0 dBm.

5. FILTER switch S4 to 15 KC (kHz) (black) position.

d. Connect a 0 dBm, 1 kHz signal to LINE jack J1 or LINE binding posts J6 and J7.

e. On PC1, adjust R234 for 0 dBm on meter M1. Refer to Figure 6—1.

f. Set FILTER switch S4 to 15 KC (kHz) (blue) position.

g. On PC3, adjust R17 for 0 dBm on meter M1. Refer to Figure 6—3.

h. Set FILTER switch S4 to 3 KC (kHz) position and adjust R217 on PC1 for 0 dBm on meter M1. Refer to Figure 6—1.

i. Set FILTER switch S4 to HIGH PASS and adjust R215 on PC1 for 0 dBm on meter M1. Refer to Figure 6—1.

j. Set FILTER switch S4 to C-MSG and adjust R213 on PC1 for 0 dBm on meter M1. Refer to Figure 6—1.

k. Replace test set in case and tighten four captive screws on front panel.

SECTION 6

ELECTRONIC PARTS LIST

6.1 **INTRODUCTION.**

6.2 This section provides the parts list and associated component location diagrams for easy location and identification of parts. Table 6—1 provides a list of FSCM (Federal Supply Code of Manufacturers) code numbers and corresponding manufacturers. Tables 6—2 through 6—12 are the parts lists. Figures 6—1 through 6—7 are the component location diagrams for the Model TTS 37BAQ/BRAQ.

6.3 Assembly 96643 in Table 6—10 applies only to modified units with the 1010 Hz notch filter. Present units have the voltage regulator incorporated into the PC1 95695 assembly as shown in Table 6—2. Component location diagram Figure 6—1 does not show the voltage regulator incorporated into the board. The following parts may be relocated or deleted from Figure 6—1: Capacitor C232, diode CR204, transistor Q212 and resistors R246 and R250.

Table 6—1. List of Manufacturers.

CODE NO.	MANUFACTURER
01121	Allen Bradley, Milwaukee, Wis. 53212
04009	Arrow Hart, Hartford, Conn. 06106
04713	Motorola Inc., Pheonix, Arz. 85008
05397	Raco Corp., Anaheim, Calif. 92803
06555	Beede Electrical Inst. Co., Inc., Concord, N.H. 03301
09653	International Electric Industries Inc., Brooklyn, N.Y.
12065	Transitron Electronic Corp., Boston, Mass. 02128
12954	Dickson Electronics Corp., Scottsdale, Arz. 85252
13606	Sprague Electric Co., Concord, N.H. 03301
19701	Electra/Midlands, Mineral Wells, Texas 71067
22650	Whale Electronics. Nashville, Tenn. 37204
27014	National Semi-Conductor Corp., Santa Clara, Calif. 95051
49671	RCA Corp., New York, N.Y. 10020
71590	Centralab Electronics, Milwaukee, Wis. 53201
72136	Electro Motive Mfg., Willimantic, Conn. 06226
72982	Erie Technological Products, Erie, Pa. 16512
75915	Littelfuse Inc., Des Planes, Ill. 60016
76854	Oak Mfg., Co., Crystal Lake, Ill. 60014
80223	United Transformer Co., New York, N. Y. 10013
81071	Schauer Mfg., Corp., Cincinnati, Ohio 45242
81073	Grayhill Inc., La Grange, Ill. 60525
81095	Traid Transformer Corp., Venice, Calif. 90293
82389	Switchcraft Inc., Chicago, Ill. 60630
86632	Newton Engineering Service Inc., Newton, Mass. 02161

Table 6—2. TTS 37BAQ/BRAQ Overall Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
F1	.3A 250V	75915	3AG	863100200
J1	JACK,TEL,SWCRFT SCHEM 12	82389	M444B	650300200
J2	SAME AS J1			
J3	JACK,TEL,SWCRFT SCHEM 16	82389	M446A	650300300
J4	SAME AS J3			
J5	SAME AS J1			
J6	BINDING POST-RED	81073	29-1R	652400400
J7	SAME AS J6			
L1	4H	86632	TN-1274	450200200
M1	1MA 1% 1%	06555	908194	900101300
PC1	37 BAQ P.C. BD ASSY 95695			A003789010
PC2	E-95523 PC BD			A003780004
PC3	QRMS ASSY			A003789011
R241	680- 1/2W 5%	01121	TYPE EB	200206815
S1	PPDT 6A 125V	04009	ST26N	620100500
S2	SPST 6A 125V	04009	ST16A	620100200
S3	300W	82389	NF4006	635300100
S4	S-4 STRAPPING & WIRING			A003789014
S5	S-5			A003780008
S6	STRAP + WIR S-6			A003780009
S7	S-7			A003780010
T1	P50 TO 600 S50K SPLIT	80223	A-20	400200100
XF1	FUSEHOLDER 3AG CHASSIS	75915	357001	863000200

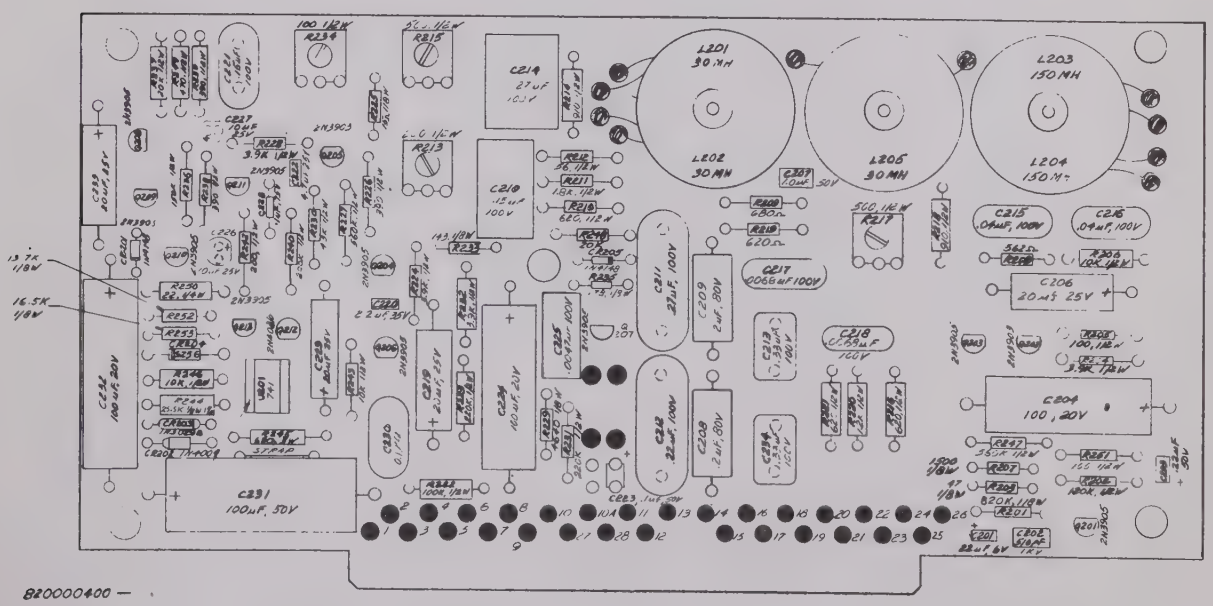


Figure 6—1. PC1 Circuit Board 95695 Component Location.

Table 6—3. TTS 37BAQ/BRAQ PC1 (95695) Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C201	22UF		10%	6V	KEMET	T330A226K006AS	310002260
C202	510PF DB	Z5R	10%	1KV	CENTRALAB	DD-511	330005110
C203	.22UF		10%	50V	KEMET	T330A224K050AS	310002240
C204	100UF			20V	CALLINS	7-65PSD100-20-S	300901071
C206	20UF			25V	C. DUBILIE	NLW-20-25	300902060
C207	1.0UF MD	Y5V	20%	50V	ERIE	8131-050-651-105M	330801050
C208-209	.2UF		2%	80V	F-DYNE	PE13-.2-80-2	322102041
C210	.15UF		10%	100V	SPRAGUE	225P15491XD3	320001540
C211	.27UF		5%	100V	F-DYNE	PED-2-.27-100-5	322002740
C212	.22UF		5%	100V	ELMENCO	IMD-3-224J	322002240
C213	.33UF		10%	100V	SPRAGUE	225P33491XD3	320003340
C214	.27UF		10%	100V	SPRAGUE	225P27491XD3	320002740
C215-216	.04UF		10%	100V	ELMENCO	1DP-1-403	321704030
C217-218	.0068UF		10%	100V	SPRAGUE	225P68291WD3	320006820
C219	20UF			25V	C. DUBILIE	NLW-20-25	300902060
C220	2.2UF		10%	35V	KEMET	T330A225K035AS	310002250
C221	.15UF		10%	100V	SPRAGUE	225P15491XD3	320001540
C222	4.7UF		10%	25V	KEMET	T330A475K025AS	310004751
C223	.1UF		10%	50V	KEMET	T330A104K050AS	310001040
C224	100UF			20V	CALLINS	7-65PSD100-20-S	300901071
C225	.0047UF		10%	100V	SPRAGUE	225P47291WD3	320004720
C226-227	10UF	B	10%	25V	SPRAGUE	196D106X9025KA1	310801061
C228	.1UF		00	75V	CENTRALAB	DDA-104	330201040
C229	20UF			25V	C. DUBILIE	NLW-20-25	300902060
C230	.1UF		10%	100V	SPRAGUE	225P10491WD3	320001040
C231	100UF			50V	C. DUBILIE	NLW-100-50	300901072
C232	100UF			20V	CALLINS	7-65PSD100-20-S	300901071
C233	20UF			25V	C. DUBILIE	NLW-20-25	300902060
C234	.33UF		10%	100V	SPRAGUE	225P33491XD3	320003340
CR201	DO35 4NS	10MA	SI	50UA	FAIRCHILD	IN4148	560041480
CR202	DO41	1A	SI	400V	EDAL	IN4004	560040040
CR203	A31A	1W	5%	24V	DICKSON	1N3029B	562030292
CR204	A140	1W	1%	5.6V	SCHAUER	SZ5.6	562000560
CR205	DO35 4NS	10MA	SI	50UA	FAIRCHILD	IN4148	560041480
L201-202	30MH	95MA	2%		TRIAD	EC-030	460100400
L203-204	150MH	56MA	2%		TRIAD	ET-150	460100600
L205	30MH	95MA	2%		TRIAD	EC-030	460100400
Q201	TO92 350MW	TC	PNP	40V	MOTOROLA	2N3905	552039050
Q202	TO-92 350MW	TA	NPN	40V	MOTOROLA	2N3903	550039030
Q203-204	TO92 350MW	TC	PNP	40V	MOTOROLA	2N3905	552039050
Q205	TO-92 350MW	TA	NPN	40V	MOTOROLA	2N3903	550039030
Q206-208	TO92 350MW	TC	PNP	40V	MOTOROLA	2N3905	552039050
Q209	TO-92 350MW	TA	NPN	40V	MOTOROLA	2N3903	550039030
Q210-211	TO92 350MW	TC	PNP	40V	MOTOROLA	2N3905	552039050
Q212	TO5 7W	TA	PNP	65V	RCA	2N4036	552040360
Q213	TO92 350MW	TC	PNP	40V	MOTOROLA	2N3905	552039050
R201	820K	1/2W	10%		AB	TYPE EB	200208246
R202	120K	1/2W	10%		AB	TYPE EB	200201246
R203	47-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220247091

Table 6—3. (Cont'd)

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
R204	3.9K	1/2W	5%		AB	TYPE EB	200203925
R205	100-	1/2W	10%		AB	TYPE EB	200201015
R206	10K	1/2W	10%		AB	TYPE EB	200201036
R207	1500-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220215011
R208	562-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220256201
R209	680-	1/2W	5%		AB	TYPE EB	200206815
R210	620-	1/2W	5%		AB	TYPE EB	200206215
R211	1.8K	1/2W	5%		AB	TYPE EB	200201825
R212	56-	1/2W	5%		AB	TYPE EB	200205605
R213	200-	1/2W	10%	200V	BOURNS	3386M-1-201	232702010
R214	910-	1/2W	5%		AB	TYPE EB	200209115
R215	500-	1/2W	10%	200V	BOURNS	3386M-1-501	232705012
R216	620-	1/2W	5%		AB	TYPE EB	200206215
R217	500-	1/2W	10%	200V	BOURNS	3386M-1-501	232705012
R218	910-	1/2W	5%		AB	TYPE EB	200209115
R219	620-	1/2W	5%		AB	TYPE EB	200206215
R220	1.2K	1/2W	10%		AB	TYPE EB	200201226
R221	620-	1/2W	5%		AB	TYPE EB	200206215
R222	100K	1/2W	10%		AB	TYPE EB	200201046
R223	220K	1/2W	10%		AB	TYPE EB	200202246
R224	3.9K	1/2W	5%		AB	TYPE EB	200203925
R225	15-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220215091
R226	390-	1/2W	10%		AB	TYPE EB	200203916
R227	560K	1/2W	10%		AB	TYPE EB	200205646
R228	3.9K	1/2W	5%		AB	TYPE EB	200203925
R229	4640-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220246411
R230	4.3K	1/2W	5%		AB	TYPE EB	200204325
R231	220K	1/2W	10%		AB	TYPE EB	200202246
R232	3.9K	1/2W	5%		AB	TYPE EB	200203925
R233	143-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220214301
R234	100-	1/2W	10%	200V	BOURNS	3386M-1-101	232701011
R235	178-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220217801
R236	150K	1/2W	5%		AB	TYPE EB	200201545
R237	20K	1/2W	5%		AB	TYPE EB	200202035
R238-239	390-	1/2W	10%		AB	TYPE EB	200203916
R240	200K	1/2W	5%		AB	TYPE EB	200202045
R242	200-	1/2W	5%		AB	TYPE EB	200202015
R243	10K	1/2W	10%		AB	TYPE EB	200201036
R244	25.5K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220225521
R245	680-	3W	5%		W LEONARD	TYPE 3X	210306815
R246	10K	1/2W	10%		AB	TYPE EB	200201036
R247	560K	1/2W	10%		AB	TYPE EB	200205646
R248	20K	1/2W	5%		AB	TYPE EB	200202035
R249	470-	1/2W	5%		AB	TYPE EB	200204715
R250	22-	1/4W	10%		AB	TYPE CB	200102206
R251	100-	1/2W	10%		AB	TYPE EB	200201016
R252	13.7K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220213721
R253	16.5K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220216521
U201	8PDIL				NAT. SEMI	LM741CN	500007412

Table 6—4. TTS 37BAQ/BRAQ PC2 (95523) Parts List.

REFERENCE DESIGNATOR	DESCRIPTION	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C101	100UF 150V	22650	PA100PV150NP	301301072
R101	42.2K 1/8W 1%	19701	MF5C	220242221
R102	84.5K 1/8W 1%	19701	MF5C	220284521
R103	1070- 1/8W 1%	19701	MF5C	220210711
R104	4530- 1/8W 1%	19701	MF5C	220245311
R105	475- 1/8W 1%	19701	MF5C	220247501
R106	SAME AS R101			
R107	316- 1/8W 1%	19701	MF5C	220231601
R108	SAME AS R105			
R109	SAME AS R107			

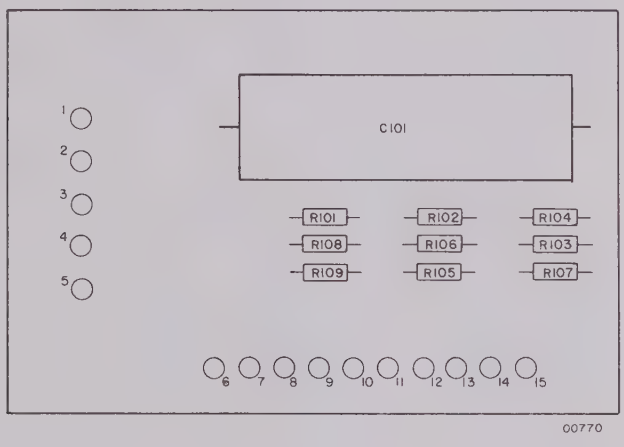


Figure 6—2. PC2 Circuit Board 95523 Component Location.

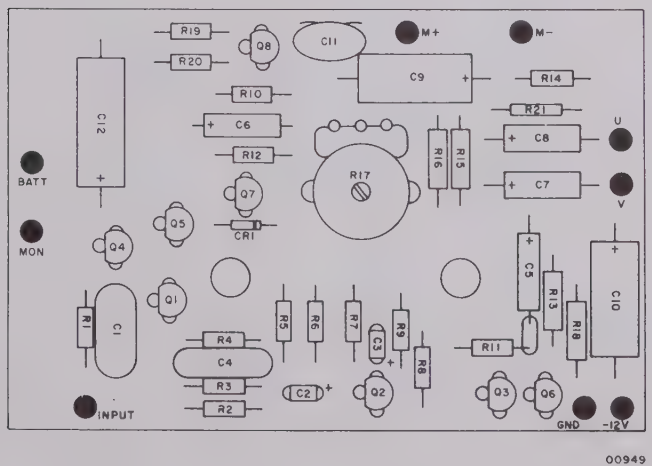


Figure 6—3. PC3 Circuit Board 95522 Component Location.

Table 6—5. TTS 37BAQ/BRAQ PC3 (95522) Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C1	.22UF	10%	100V	13606	225P22491XD3	320002240
C2	4.7UF	10%	25V	05397	T330A475K025AS	310004751
C3	10UF	10%	10V	05397	T330A106K010AS	310001060
C4	.01UF	10%	100V	13606	225P10391WD3	320001030
C5	22UF	10%	15V	13606	150D226X9015B2	310302260
C6	SAME AS C5					
C7	10UF	10%	20V	13606	150D106X9020B2	310301060
C8	SAME AS C7					
C9	56UF	10%	15V	13606	150D566X9015R2	310305660
C10	SAME AS C9					
C11	.1UF	00	75V	71590	DDA-104	330201040
C12	20UF		16V	13606	TE1157	300202060
CR1	DO35	500MW	75V	12065	1N4148	560041480
Q1	TO92HSS	310MW	40V	04713	2N3903	550039030
Q2	TO92MSS	310MW	40V	04713	2N3905	552039050
Q3	SAME AS Q2					
Q4	SAME AS Q2					
Q5	SAME AS Q1					
Q6	SAME AS Q2					
Q7	SAME AS Q1					
Q8	SAME AS Q2					
R1	4.7K	1/4W	10%	01121	TYPE CB	200104726
R2	330K	1/4W	10%	01121	TYPE CB	200103346
R3	100K	1/4W	10%	01121	TYPE CB	200101046
R4	6.8K	1/4W	10%	01121	TYPE CB	200106826
R5	15K	1/4W	10%	01121	TYPE CB	200101536
R6	SAME AS R5					
R7	5.6K	1/4W	10%	01121	TYPE CB	200105626
R8	1.2K	1/4W	10%	01121	TYPE CB	200101226
R9	SAME AS R8					
R10	100-	1/4W	10%	01121	TYPE CB	200101016
R11	33-	1/4W	10%	01121	TYPE CB	200103306
R12	SAME AS R11					
R13	3.3K	1/4W	10%	01121	TYPE CB	200103326
R14	SAME AS R13					
R15	820-	1/4W	10%	01121	TYPE CB	200108216
R16	150-	1/4W	10%	01121	TYPE CB	200101516
R17	100-	1/2W	10%	200V HELIPOT	72PXR100	232701011
R18	SAME AS R10					
R19	180-	1/4W	10%	01121	TYPE CB	200101816
R20	220K	1/4W	10%	01121	TYPE CB	200102246
R21	SAME AS R10					

Table 6—6. TTS 37BAQ/BRAQ Switch Assembly S5 Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
E1		20%	90V	SIEMENS	B1-C90/20	566009020
SW5		1A	28V	76854	272837-K3	626301000

Table 6—7. TTS 37BAQ/BRAQ Switch Assembly S6 Parts List.

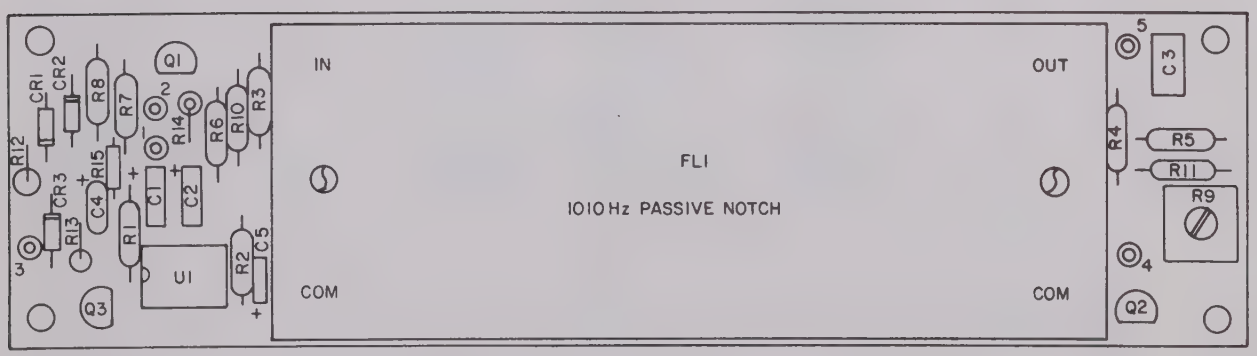
REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
R15	22.6-	1/8W .5%		19701	MF5C	220322697
R16	26.1-	1/8W .5%		19701	MF5C	220326197
R17	29.4-	1/8W .5%		19701	MF5C	220329497
R18	33.2-	1/8W .5%		19701	MF5C	220333297
R19	36.5-	1/8W .5%		19701	MF5C	220336597
R20	41.2-	1/8W .5%		19701	MF5C	220341297
R21	46.4-	1/8W .5%		19701	MF5C	220346497
R22	52.3-	1/8W .5%		19701	MF5C	220352397
R23	59-	1/8W .5%		19701	MF5C	220359097
R24	66.5-	1/8W .5%		19701	MF5C	220366597
R25	191-	1/8W .5%		19701	MF5C	220319107
SW6		1A	28V	76854	269428-J2C	626200100

Table 6—8. TTS 37BAQ/BRAQ Switch Assembly S7 Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
CR6	DO35	500MW	75V	12065	1N4148	560041480
CR7	SAME AS CR6					
R1	20K	1/8W .5%		19701	MF5C	220320027
R2	63.4-	1/8W .5%		19701	MF5C	220363497
R3	205-	1/8W .5%		19701	MF5C	220320507
R4	13.7K	1/8W .5%		19701	MF5C	220313727
R5	649-	1/8W .5%		19701	MF5C	220364907
R6	46.4K	1/8W .5%		19701	MF5C	220346427
R7	2K	1/8W .5%		19701	MF5C	220320017
R8	196K	1/8W .5%		19701	MF5C	220319637
R9	6.34K	1/8W .5%		19701	MF5C	220363417
R10	SAME AS R1					
R11	SAME AS R1					
R12	19.6K	1/8W .5%		19701	MF5C	220319627
R13	17.8K	1/8W .5%		19701	MF5C	220317827
R14	SAME AS R4					
SW7		1A	28V	76854	269425-F4	625800900

Table 6—9. TTS 37BAQ/BRAQ Notch Filter Assembly (96623) Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C1	2.2UF	10%	35V	05397	T330A225K035AS	310002250
C2	3.3UF	10%	25V	05397	T330A335K025AS	310003350
C3	SAME AS C1					
C4	120UF	10%	15V	SPRAGUE	196D127X9015TE4	310801270
C5	SAME AS C1					
CR1	DO35	500MW	75V	12065	1N4148	560041480
CR2	SAME AS CR1					
CR3	SAME AS CR1					
FL1	1010 HZ			ESC ELECT.	ESC 42F86	470100700
Q1	TO92			MOTOROLA	2N5087	552050870
Q2	TO92			MOTOROLA	2N5089	550050890
Q3	TO92AFA	310MW	25V	04713	MPS6519	552065190
R1	590K	1/8W	1%	19701	MF5C	220259031
R2	464K	1/8W	1%	19701	MF5C	220246431
R3	604-	1/8W	1%	19701	MF5C	220260401
R4	619-	1/8W	1%	19701	MF5C	220261901
R5	14.7K	1/8W	1%	19701	MF5C	220214721
R6	48.7K	1/8W	1%	19701	MF5C	220248721
R7	3480-	1/8W	1%	19701	MF5C	220234811
R8	3740-	1/8W	1%	19701	MF5C	220237411
R9	5K	1/2W	10% 200V	HELIPOT	72PMR5K	232705023
R10	2430-	1/8W	1%	19701	MF5C	220224311
R11	4.7K	1/8W	1%	19701	MF5C	220247011
R12	1K	1/2W	10%	01121	TYPE EB	200201026
R13	56-	1/2W	5%	01121	TYPE EB	200205605
R14	20K	1/8W	1%	19701	MF5C	220220021
R15	SAME AS R12					
U1	8PDIL			27014	LM741CN	500007412



01029

Figure 6—4. TTS 37BAQ/BRAQ Notch Filter 96623 Component Location.

Table 6—10. TTS 37BAQ/BRAQ Voltage Regulator Assembly (96643) Parts List. (For Models With Separate Voltage Regulator)

REFERENCE DESIGNATOR	DESCRIPTION		MFGR.	MFGR. PART NO.	N.E.C. PART NO.
CR1	A140	1W 1% 5.6V	81071	SZ5.6	562000560
Q1	TO5MSS	5W 65V	49671	2N4036	552040360
Q2	TO92MSS	310MW 40V	04713	2N3905	552039050
R1	10K	1/4W 10%	01121	TYPE CB	200101036
R2	22-	1/4W 10%	01121	TYPE CB	200102206
R3	13.7K	1/8W 1%	19701	MF5C	220213721
R4	10.2K	1/8W 1%	19701	MF5C	220210221
U1	8PDIL		27014	LM741CN	500007412

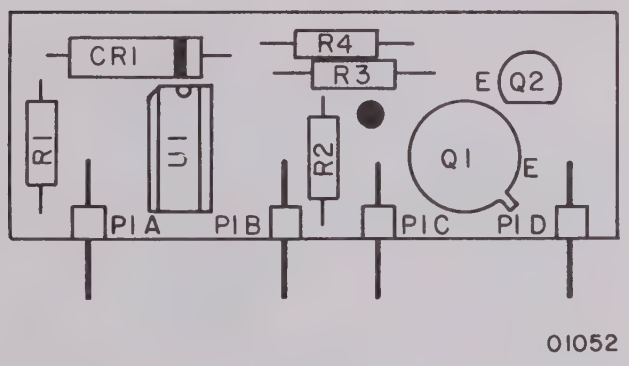
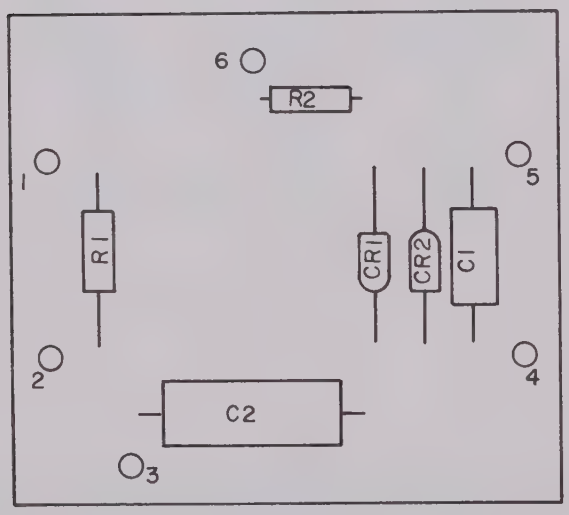


Figure 6—5. TTS 37BAQ/BRAQ Voltage Regulator Circuit Board 96643 Component Location (For Models With Separate Voltage Regulator)

Table 6—11. TTS 37XDT Overall Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C1	.20UF 10% 100V	13606	225P20491XD3	320002040
C2	.68UF 10% 200V	13606	118P68492S2	320106840
CR1	D041 3 400V	12065	IN4004	560040040
CR2	SAME AS CR1			
J1	JACK,TEL,SWCRFT SCHEM 4	82389	L12B	650100300
J2	HI-D	82389	111	650100800
J3	SAME AS J2			
L1	TALK COIL	CECO	CE-104A	450100100
R3	47- 1/2W 10%	01121	TYPE EB	200204706
R4	12- 1/2W 5%	01121	TYPE EB	200201205
S1	SPST 6A 125V	04009	ST12A	620100100

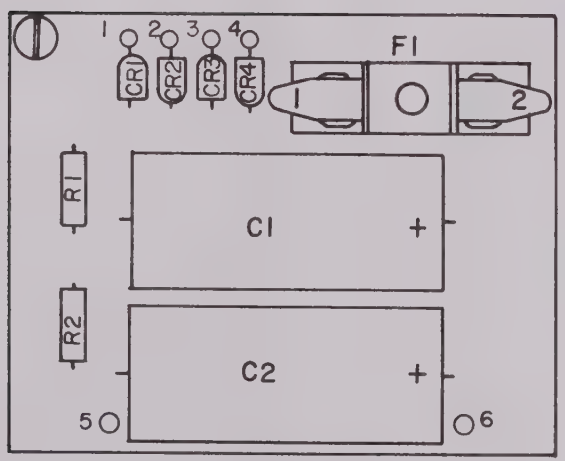


00790

Figure 6—6. TTS 37XDT Circuit Board 1 Component Location.

Table 6—12. TTS 37XPS Overall Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION	MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C1	100UF 150V	13606	TVA1420	300401071
C2	SAME AS C1			
CR1	D041 200V	12065	1N4003	560040030
CR2	SAME AS CR1			
CR3	SAME AS CR1			
CR4	SAME AS CR1			
F1	FUSEHOLDER FUSE EXT	75915	341001	863000300
F2	FUSEHOLDER 3AG CHASSIS	75915	357001	863000200
J1	JACK,TEL,SWCRFT SCHEM 4	82389	12B	650101000
R1	51- 1/2W 5%	01121	TYPE EB	200205105
R2	SAME AS R1			
S1	DPST 6A 125V	04009	ST26K	620100400
T1	35MA	81095	F-94X	420100200



00789

Figure 6—7. TTS 37XPS Circuit Board 1 Component Location.

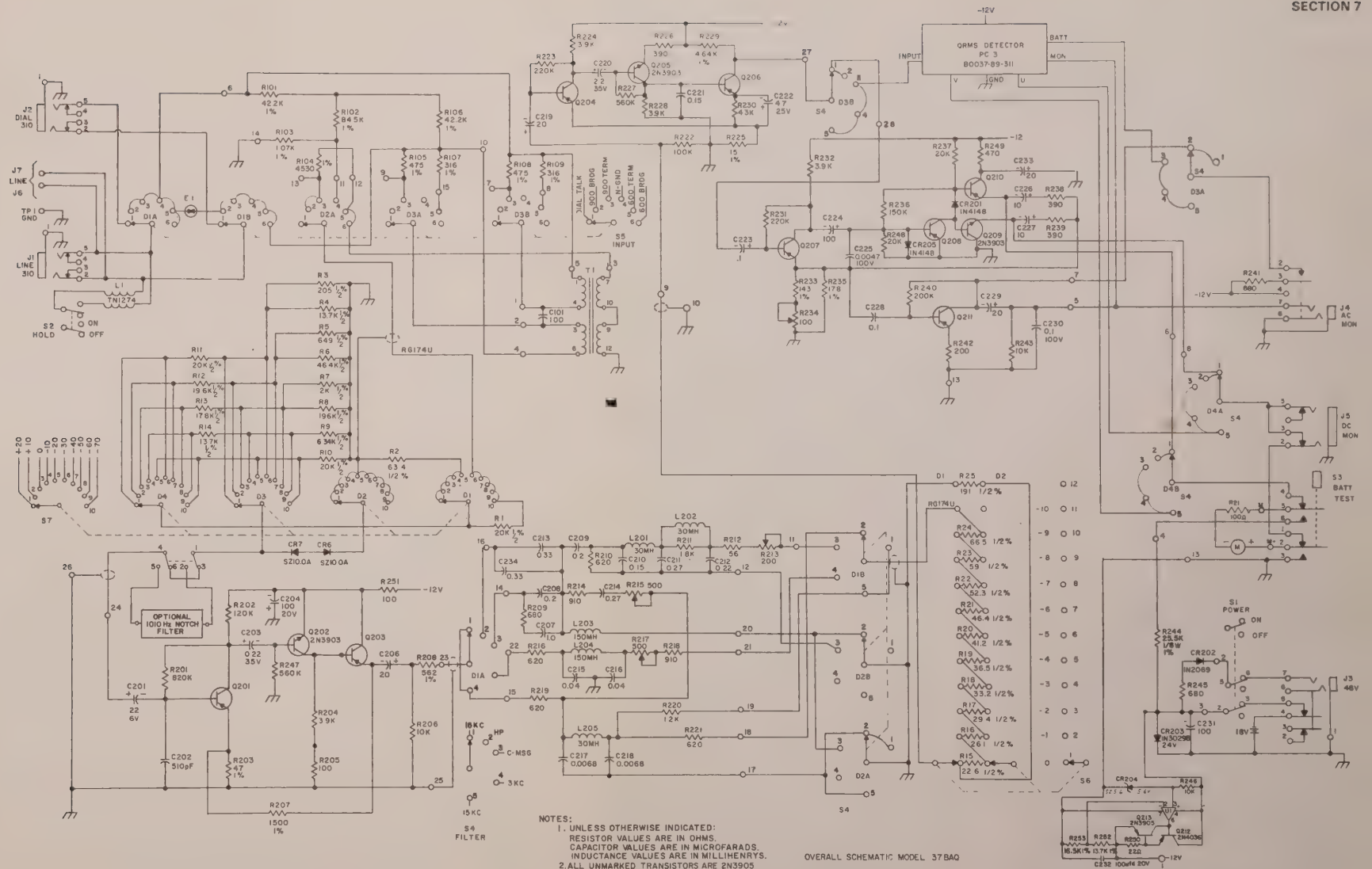
SECTION 7

SCHEMATIC DIAGRAMS

7.1 **INTRODUCTION.**

7.2 This section provides the schematic diagrams for the TTS 37BAQ/BRAQ Noise-Level-VU Measuring Set and accessories.

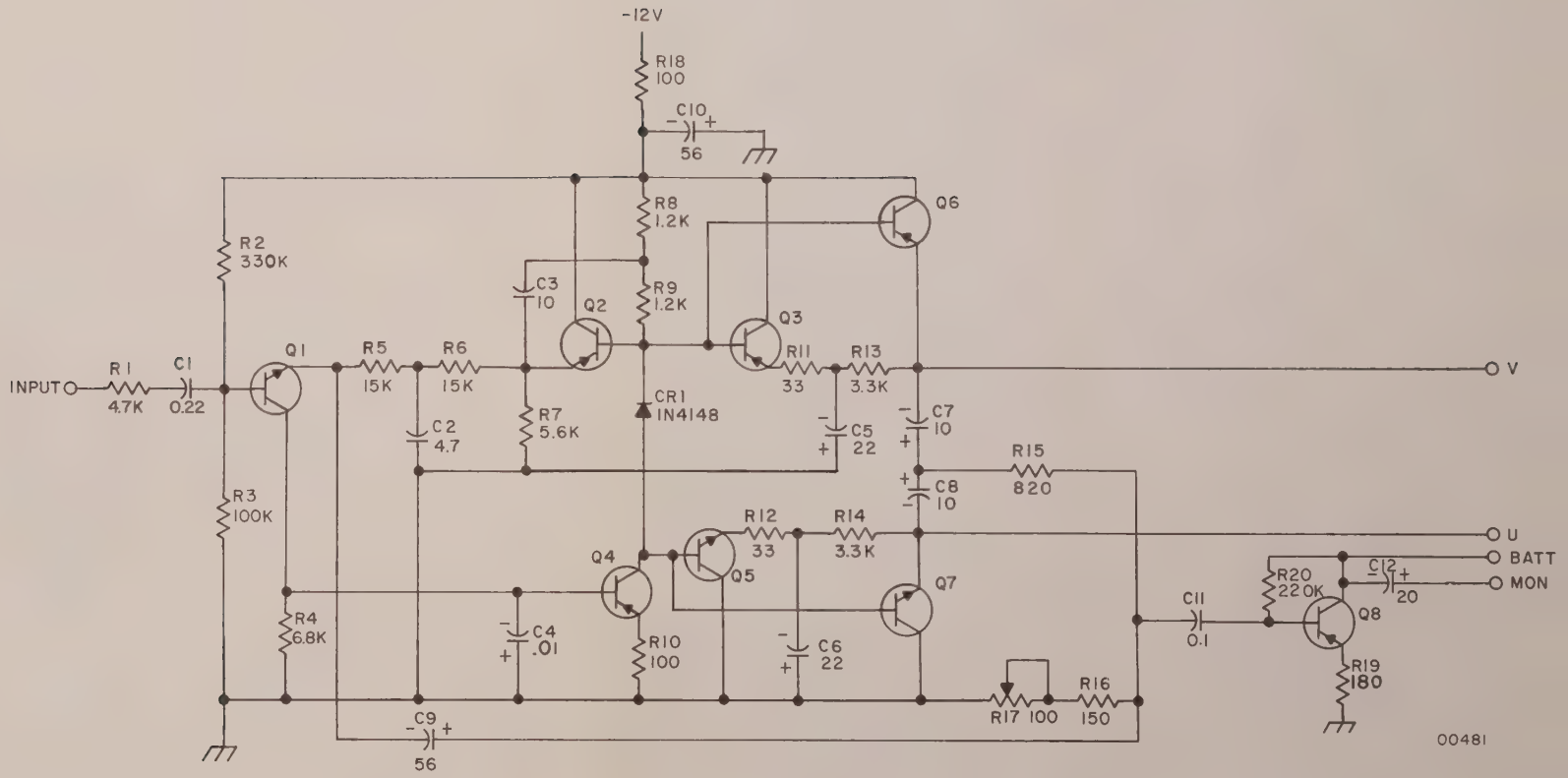
7.3 The voltage regulator schematic diagram in Figure 7—3 only applies to modified units. Present units use the voltage regulator incorporated into PC1.



NOTES:
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS.
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.
2. ALL UNMARKED TRANSISTORS ARE 2N3905

OVERALL SCHEMATIC MODEL 37BAQ

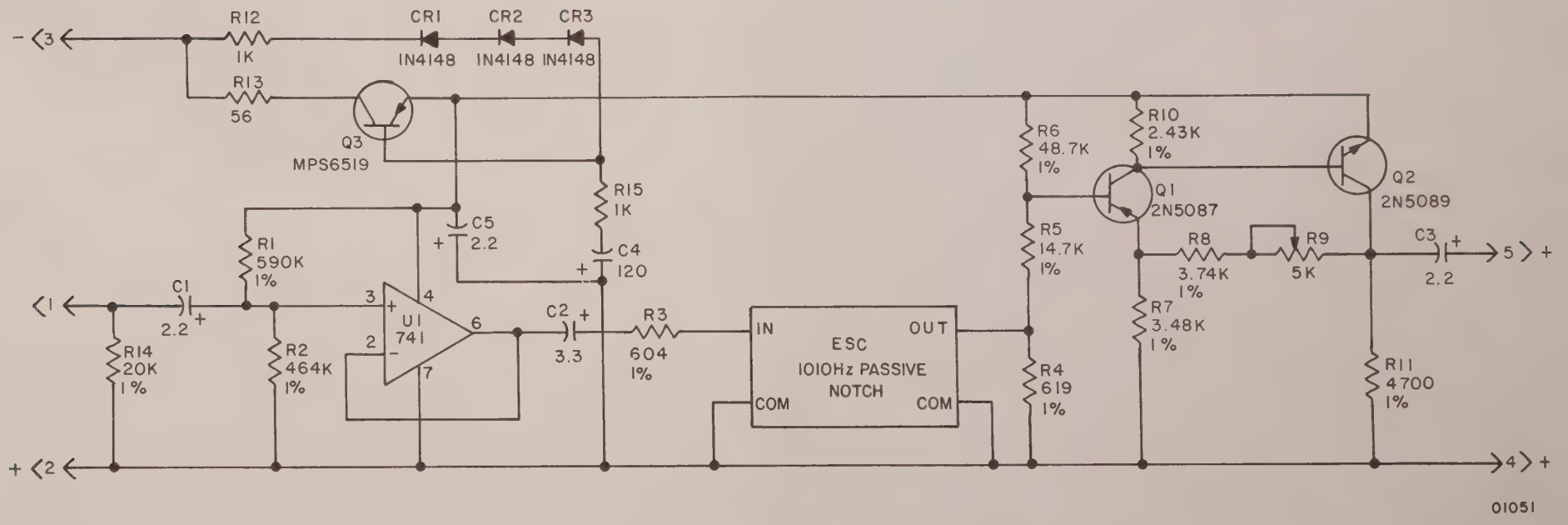
Figure 7—1. TTS 37BAQ/BRAQ Overall Schematic Diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS.
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.

Figure 7—2. TTS 37BAQ Quasi-RMS Detector PC3 Schematic Diagram.



PCB (96623)

Figure 7—3. TTS 37BAQ/BRAQ 1010 Hz Notch Filter Schematic Diagram.

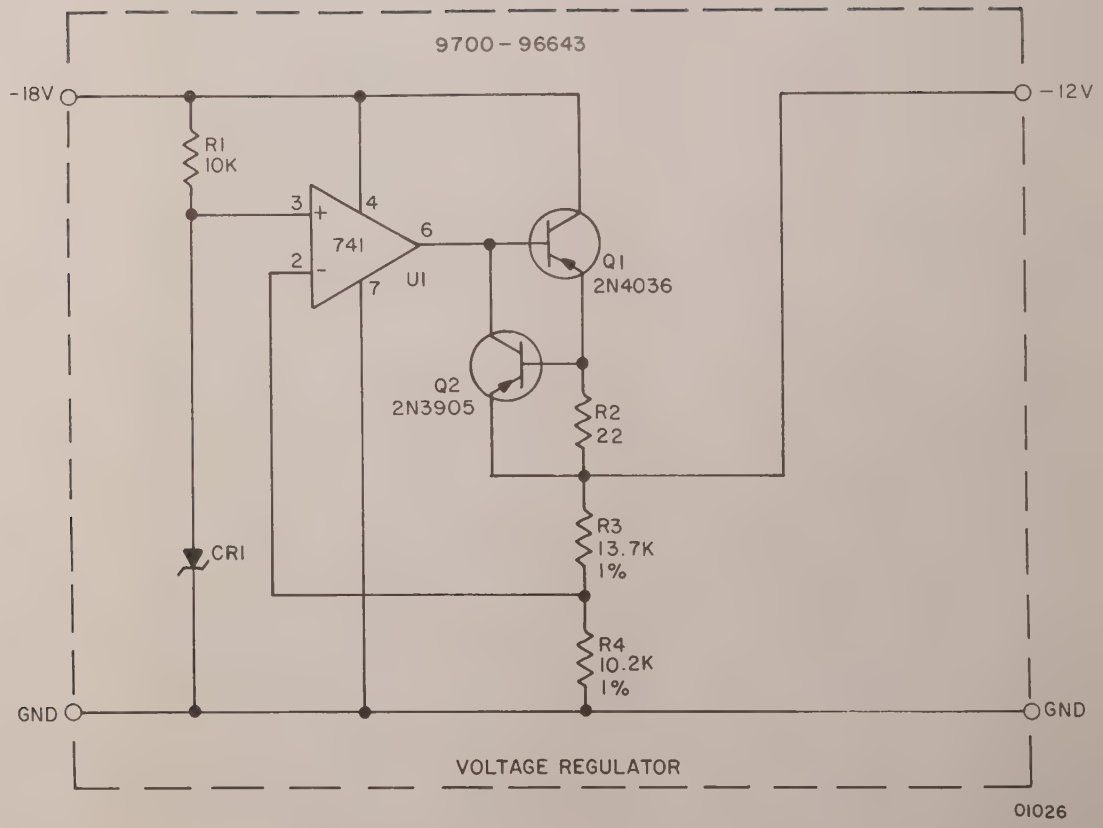


Figure 7—4. Voltage Regulator Schematic Diagram (For Models With Separate Voltage Regulator)

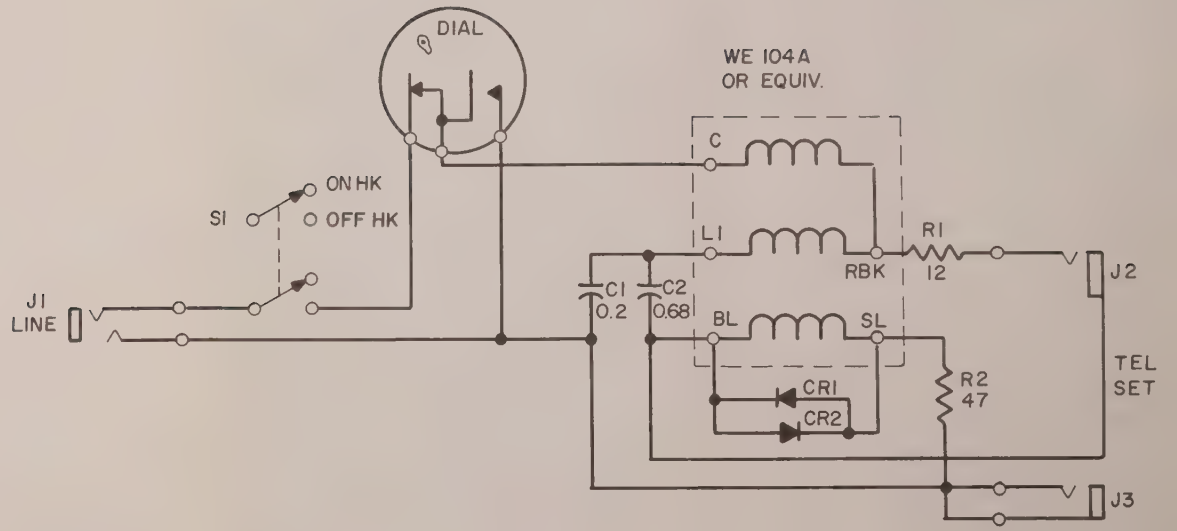
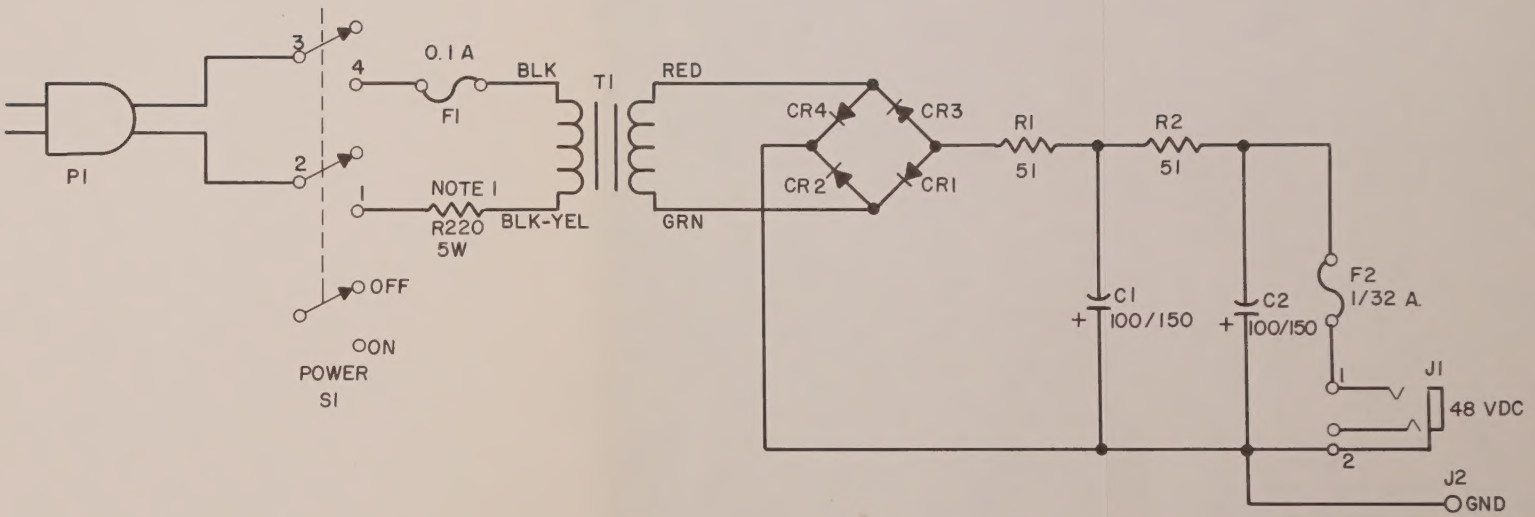


Figure 7—5. TTS 37XDT Schematic Diagram.



NOTES;

1. R220 ADDED FOR 220V OPERATION AND IS APPROXIMATELY 2000Ω.
2. ALL RESISTORS ARE IN OHMS AND 1/2 W UNLESS OTHERWISE NOTED
3. DIODES ARE IN4003

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Figure 7—6. TTS 37XPS Schematic Diagram.

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